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ABSTRACT

Librarians and their concerned colleagues met to give, hear and discuss papers on library automation, primarily by computers. Noted at this second meeting on library automation were: (1) considerably more sophistication and casualness about the techniques involved, (2) considerably more assurance of what and where things can be applied and (3) considerably more realizations of the complexity and the time-spans involved in the changes with which librarians are faced. Papers presented include: (1) Capability of the IBM-360 On-line System for Library Automation, (2) New Programs from Old - MARC and the Bibliographical Record, (3) The Library as a Total Information Resource and (4) Organizational Analysis and Simulation Studies of University Libraries. The panel session was on library professionalism vis-a-vis the computer. All the papers given, except one, are presented in the proceedings. Some of the discussion was omitted. A description of a workshop clinic which was part of the program is included. (NH)

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PAPERS PRESENETED
at the
MEEING ON
AUTOMATION PROBLEMS OF 1968.

October 4-5, 1968

Sponsored by the
Purdue Univeraity Libraries
with the cooperation of the
Indiana Chapter of the Special Libraries Association .

Edited by
Theodora Andrews, Meeting Chairman

Purdue University, Lafayette, Indiana
1969

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PREFACE

The meeting on "Automation Problems of 1968" was held on the Purdue University Lafayette Campus October 4-5, 1968, just four years after the meeting on "Automation in the Library--When, Where, and How."

The meeting was under the direction of meeting chairman Mrs. Theodora Andrews, Pharmacy Librarian, Purdue University and co-chairman Molete Morelock, Coordinator of the Regional Campus Libraries of Purdue University. A number of other members of the Special Libraries Association Indiana Chapter and Purdue Libraries staff members assisted.

All the papers except one are presented here although some discussion has been omitted. Also a description of a workshop clinic which was part of the program is included.

The meeting is actually the third gathering of this kind sponsored by the Indiana Chapter of the Special Libraries Association. The first, held in Bloomington, Indiana on the Indiana University Campus in 1960 was called "Institute on Channels of Communication for Special Libraries."

Papers presented at the other two meetings were also made available by the Chapter.

AUTOMATION PROBLEMS OF 1968

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INTRODUCTION

This second gathering of librarians and their concerned colleagues to give, hear, and discuss papers on library automation, primarily by computers, inevitably invites comparison with the first. The first involved definite acts of faith by the organizers and the attendees. Some were justified by the benefits of that first gathering's instant delivery of papers and the hearing and discussion of them and other automation ideas in the days of the meeting itself. Considerable surprise came at the immediate sale of all copies of those proceedings as first produced. And a quite drawn-out and long-continued demand for those first papers has been maintained. Obviously librarians wanted to hear about automation and computers from the librarians themselves who had experience or from paraprofessionals working closely with librarians on library jobs which used these new facilities.

Our Purdue staff concerned was determined not to be calendared into any annual, biennial or other such renewal of the meetings but a break of four years and the changes experienced locally and among our neighboring institutions did seem to justify offering to host another automation meeting. And this time the importance of the publication of the papers to be given has been a key element in all planning, not as it was with those of the 1964 meeting, really something of a dutiful gesture to our speakers.

There is no need here to abstract the findings and ideas of the various papers. These are not long or abstruse, but sensibly brief, practical, and direct in their descriptions and prescriptions. What should be noted here is (1) considerably more sophistication and casualness about the techniques involved; (2) considerably more assurance of what and where things can be applied; (3) considerably more realizations of the complexity and the time-spans involved in the changes with which we are faced. Neither the sophistication, assurance, nor the realization should be mistaken for disillusion with, nor withdrawal from, the undertakings we face and are to face. In this attitude, librarians are sharing the general experiences of all computer users. Many readers in academic positions must recently have smiled ruefully when they received the following letter from the Teachers Insurance and Annuity Association of America and College Retirement Equity Fund Company that holds their annuities:

Teachers Insurance and Annuity Association
of America
College Retirement Equity Fund
730 Third Avenue, New York
Thomas C. Edwards, President
February 25, 1969

To TIIAA-CREF Annuity Owners:

THE MARGINAL LEGIBILITY OF THIS PAGE IS DUE TO POOR ORIGINAL COPY. BETTER COPY WAS NOT AVAILABLE AT THE TIME OF FILMING. E.D.R.S.

"We are sorry to report that the year-end Blue and Yellow Slips (TIAA and CREF Reports of Premiums and Benefits), usually mailed out in March, will not be in the mail to you this year until July or August. In converting to the new generation of computers, we didn't escape the generation gap that has plagued so many organizations.

Some time ago, TIAA-CREF's rapid growth and the possibility of providing new services for annuity owners dictated a major change in our processing equipment and methods. We planned for the change in great detail, but, as we had been warned, no amount of preparation and testing really insures against all of the new and unique problems that can crop up in actually converting to the new electronics. We were no exception. As our understanding and helpful college business officers know, these problems put our monthly accounting behind schedule. Now, with the new equipment working smoothly around the clock, we're making good progress on catching up, while keeping all other functions going at the same time.

When we're back to normal, we will be able to provide faster, more efficient service than ever before, and will be storing new data for your convenience. But in the meantime, we must ask for your patience "(Note: more facts were described which are specific, not general as above).

If this is the experience of a multi-million dollar company in a key center of computer know-how and staff capabilities, what can we librarians expect? Indeed librarians, with always thinly stretched budgets, will have to ask even greater patience of their colleagues on library staffs and of their users. However, if the information industry is to reach the size predicted for the year 2000 AD, and if librarians are to preside over the "banks" of that industry, then, we librarians have our work cut out for us. The little girls are not being vorn who would be needed to handle such a load of work manually--even to meet current expectations. With the inevitable load of communications coming our way and with the mounting expectations, as well as sheer numbers, of users, also inevitable, we will need computers and more computers, and all our personal intellects and many more intellects, to get the required job done.

John H. Moriarty
Director of Libraries
Purdue University

Lafayette, Indiana
April 11, 1969

CAPABILITY OF THE IBM/360 ON-LINE SYSTEM FOR LIBRARY AUTOMATION

T. V. DeLay
Director
Administrative Data Processing Center
Purdue University

I think that perhaps the best way of starting this discussion is to briefly explain the components that make up an on-line system for not only the /360 but for all computers. The first essential is the CPU which stands for Central Processing Unit. In this unit the program or set of instructions resides. The CPU is sometimes called 'main memory' but I rather dislike the humanistic connotations of such a term which is, to say the least, misleading. Fortunately we seldom hear the phrase 'Giant Brain' these days and we are much better off. Computers and particularly those components involving the central processing unit are rather remarkable and sometimes wondrous machines but certainly nothing more. The program does the necessary work of finding a record or file and doing something with the information. While doing this job, the unit on which the file is stored comes into play. In an on-line system this is usually a disc file or a mylar card file, either of which has many distinct storage locations which can be directly accessed.

It might be well to digress somewhat and discuss the primary difference between an on-line system and a tape system. The latter records on a magnetic tape in a manner similar to the sound tapes with which many of you are familiar. This is almost always done in a formal ascending sequence much like the alphabetic card files librarians work with. Exactly like sound tape, to get to a record, you must pass all tape preceding the one you desire. Unlike the alphabetic card file, you cannot go directly to information starting with S. Instead, you must laboriously go A through R to get to the S section. Obviously it would be foolish to follow your S with a Q causing the search to back up completely and start over with A again. It makes sense to sort your searches into the same order as the file arrangement so that all of your items can be found in one tape pass. These tape systems are quite efficient when a group or 'batch' of items are accessed at one time and are known rather logically as 'batch-sequential' systems.

On-line systems, on the other hand, feature one or both of the disc and mylar card units mentioned earlier. To again draw on the analogy of your card files, this time it is possible to go directly to the record you wish to find and in much the same way as the card file. The various locations, tracks, cylinders or what have you, are labeled exactly as your card files are labeled so that the reading devices in the units can access the record directly. This term, 'Direct Access', is used to describe the type of units. They used to be known as 'Random Access' units but that word 'random' didn't do much for the image of a hopefully accurate and scientific procedure so we changed it. It's really marvelous what you can do with semantics. Unfortunately procedures aren't quite as easily changed.

These direct access units are usually distinguished by their rather large capacity with this being particularly true of some of the /360 units. Their capacities range from nine million characters to well over 400 million. To put that in perspective, it is reasonable to assume that a bibliography card might be condensed into 200 characters so that a library of 1 million volumes could be stored on the larger capacity unit and would take less than half of the available space.

The third component essential to an On-line system is known by various names such as terminal, console, teleprocessing or telecommunications device. Typewriter or teletype machines are common illustrations of this with the much more exotic cathode-ray-tube units providing visual display currently receiving much publicity. This type of device is the component with which you will become familiar in the On-line system because it will literally be living with you. From our past experience here at Purdue It will be a somewhat difficult relationship in the early stages. One of the typewriter type devices is more easily assimulated because of its familiarity. The cathode-ray-tube however is probably more effective because of the quick and reasonably extensive display capabilities which can give you up to 960 characters displayed on the small size screen.

There are many more additional features available and usually present on any computer but they really do not affect your functional use of the computer for Library Automation.

The IBM Series /360 computer has all of the basic essentials mentioned in extensive variety and array. Our /360 has been installed and operating very satisfactorily since April of this year. We have some On-line jobs in operations with many more in development and in the planning stage. IBM has done considerable work in the development of Library Systems and Programs and I recommend that any of you interested can contact your local representative to discuss these. In addition there are some films which you will find interesting dealing with information retrieval and dissimanation of this information. If time permits we will show you the film on Administrative Terminal Systems which shows text editing capabilities. I believe the State University of New York at Buffalo is using this system to convert their catalog.

Rather than explore these facets, however, I feel that it might be more informative to explain several potential on-line operations and how they might work.

It always takes a certain amount intestinal fortitude and perhaps thick skin to delve into an operation with a group of people who are quite knowledgeable when you are not. However, the job description of a Data Processing Manager almost always includes the first two attributes and perhaps if I admit ignorance you will forgive me when I make errors in interpretation of your business.

I will attempt to guide you through a hypothetical Acquisition System that could be installed on the /360 System we have at Purdue. For purposes of interest I think it might be interesting to consider the use of cathode-ray-tube devices instead of typewriters. Those of you who would prefer typewriters can substitute them in your thinking or consideration. Following that, I will try and present several of the uses you might make of the by-products and amplifications of such a system.

If you'll bear with me, let's ignore the process by which a publication gets to the order point or unit and start at that point. The device on which we will start is an IBM 2260 which I briefly described earlier. In addition to the display screen for output, it has a typewriter keyboard for input. This means that information will be keyed as with any normal typewriter. In our particular situation, we will automate rather extensively so we must have several classification systems available. The first would be easy, being the account or cost center to charge. The second is almost as easy, being a document mumber so that the order can be identified. The third is considerably more difficult being a vendor identification. We assume that all of these systems classifications have files set up in the mass storage devices on the computer. First of all we enter the account to be charged on the keyboard and the account name or cost center is printed on the display as affirmation that such an account exists. If we have mis-keyed we received a message that perhaps there is no such account. It is also possible to point out the rather embarrassing fact as to whether that account has funds to make such a purchase by entering price. I leave this to you as to whether you wish to have overdrawn friends or solvent enemies if such a condition exists. Next we enter the document number which will use later.

Now let's automate by entering a vendor number. The screen will display the name and address of the vendor so that you can verify the corrections. If the source of supply is new or rarely used you might have to enter this information into the file. Again you can see the information entered. Now the normal title and author data plus an estimate of price. Having assured yourself of the accuracy of the information to depress an 'Enter' key which stores the data on the computer system. You continue the process until finished with your orders. Sometime in the hours following, usually at night, these orders will be sorted by vendor and consolidated orders will be printed out on the main printer of the computer.

It would now be nice to assume that these nicely consolidated orders would get to be nicely consolidated shipments but somehow I have the feeling that this won't always happen. This means that you still will have the 'nitty gritty' of matching and auditing. After this is done you can enter the receipted items by order number and price. This will take the item out of the outstanding order file, charge the necessary account and store the data for consolidated payment in a manner much like the consolidated orders. The outstanding file can be inquired into by vendor or by order number if your irate local patron wants to know about his book. We have not destroyed any information entered into the system other than perhaps the original price estimate but have completed the acquisition process.

I will now pass over the agony of classification sidestepping any discussion of Dewey or LC, leaving you with that problem. I will also sympathize with your problems in cataloging and bibliography assuming that you will triumph somehow. Once you have accomplished these things, however, I want to lead you back to the ever faithful 2260. Enter the order number and the title, author, publisher, will be displayed. Now enter the classification and bibliography. Your record on the publication is ready for some more automation. Again, as with the orders and checks, labels can be printed with any classification and call numbers for application to the book. In addition, the catalog file card can be printed for you for insertion. At the same time, however, this same information is stored on-line in the computer for various purposes. Assuming you have either converted or have a complete file in this manner a book catalog can be printed from the file on the computer printer. This is one of Professor Moriarty's goals here at Purdue but since it has nothing to do with on-line systems I will leave the comments at that point.

Let's pursue some of the other possibilities which do use the instant access possibilities of the on-line file. First is circulation, other devices which can read badges or plastic ID cards can provide a circulation system. For example, I believe several libraries, including Eastern Illinois at Charleston, have such a system. This system can provide you with information as to whether you have the publication on your shelves or as to which patron has withdrawn it.

Probably more value however is the research implication of being able to search at computer speeds for bibliographical information. I would think that, particularly for Special Libraries and Librarians this would be more interesting and of more benefit to your patrons. The display screen of the 2260 is an excellent searching or scanning device. Depending on programs written, many retrieval or inquiry uses should be available to you use or your patrons. The 2260's used by your patrons need not be in the library but can be in other locations.

I trust that you have forgiven me for any errors in my hypothetical system. If you understand on-line systems concepts more or if I have stimulated your thinking, my time and yours has been well spent.

NEW PROGRAMS FROM OLD -- MARC AND THE BIBLIOGRAPHICAL RECORD

Hillis L. Griffin
Information Systems Librarian
Argonne National Laboratory

I'm sort of a schizophrenic librarian as I am a librarian and also a computer man, and from the description given here I'm not sure where I fit. I'm a systems analyst and a programmer, and I'm a systems programmer. The whole thing is my responsibility at Argonne, and I must say that library automation is not new to me either. I was just counting on my fingers on the way down here, and I find that I've been doing library automation for some ten years now. Things haven't changed much. It seems like the problems are always related to the equipment. We have problems today, and we had problems before.

I think that one of the main problems we see is that we simply have so much information to store, so much information to which we want access, that it is very difficult to get access to this at reasonable speeds and to give a lot of users this same information. I think that the word "problems" in the title is appropriate, and I would nominate for the Problem of 1968 the Marc system which the Library of Congress gives to one and all with a ribbon around it. However, it's a problem that has its blessings with it.

The problem is that users will be responsible for determining what they do with this information. I think that so often people are so used to getting things from the Library of Congress, and they use the material in very traditional ways. We get catalog cards from the Library of Congress and type tracings and call numbers on the top and file them in our catalogs. We get the *National Union Catalog*, and this is a source of cataloging information again, to prepare a very common product, a product that is common to all libraries.

Now the Library of Congress proposes to give people catalog information that they can use as they please. They can print their own catalog; they can print their own catalog cards; they can print indexes; they can do selective dissemination of information; they can do subject searches. They can do anything they want, and what they do is their decision. It is not conditioned on the physical format of the record they're getting. It is very difficult to manipulate 3 x 5 cards in any meaningful way. We file them and that's about the extent of the manipulation. It is very difficult to find the records for all the books published in 1965 which are in Russian on a certain subject or subjects. It's very difficult to find all the juvenille books if we don't go through the catalog one card at a time. There is no way to put the computer to work on the information on the 3 x 5 cards. It's just plainly not machine readable, and this is one of the limitations of the computer. It wants things in machine readable form. So what's happened then is that the Marc project was initiated by the Library of Congress to investigate the problem of putting this information to machine readable form, and also to make the information on the 3 x 5 cards, and indeed more information, available to users throughout the country, and to let them use this information in any way they please, to try to find ways to use it. This, then, was the substance, the essence of the Marc project which has been running for about the last year and a half.

The first Marc project terminated; we sent the last Marc I tapes out in July, and now comes Marc II. Everything has an acronym these days, you know. We had Cobal and Fortran here, and I suppose since Marc is computer related it had to have an acronym as well, so Marc stands for Machine Readable Cataloging. Ma is for machine, r for readable, and c for cataloging. The new project we see coming from L.C.is Marc II, the improved version of the Marc record. This is fitting as the first Marc had a test or trial period. You may recall that Marc was a cooperative scheme originally started with sixteen libraries. These sixteen were sent a Marc tape every week with bibliographic records. When the libraries joined the project they were furnished with programs which would get standard products out of this records--catalog cards, indexes, and this sort of thing. We had some attrition at the start; the programs didn't work and some libraries were just not prepared to deal with this. After all the Library of Congress had done for them all these years, they weren't really used to doing for themselves in this area. So some of our users fell immediately by the wayside when programs were formed. What happened was there wasn't any computer competence in the library. The people in the computer center either didn't have time or couldn't handle the Marc program, and the people in the library didn't know how to do anything with them. So many of our users fell by the wayside almost immediately when the programs didn't work. Some of our libraries, however, were able to use the programs and were able to modify them. They had computer competence in the library, and indeed some of our best users did not use the Marc programs but developed programs of their own by using the Marc information in different ways.

I think this was perhaps one of the major lessons of the Marc project--that libraries need to develop a computer competence, that really you can't depend on somebody else to do your work. I do not think that we can depend on some other group on campus to do our cataloging; we don't depend on some other group to do our reference work for us, and it seems to me then that we really can't depend on some other group on the campus or within our organization to do our computer work for us. Somehow this has to be related to the library. I think that librarians can do this rather well; they know the library and they can learn about computers. I haven't found it that difficult, and I have found others who have not found it that difficult.

But here we have Marc II. Now what is Marc II? Well, it is simply all the English language monographic cataloging which is issued each week by the Library of Congress which is represented in a computer tape. It sounds a lot like proof sheet service, and I presume that you are all familiar with proof sheets. It is proof sheets, all the information that the libraries get from proof sheets if you take out the items in Chinese, Persian, and the Cyrillic alphabet, and this sort of thing. The objective of the Marc II service is to give people catalog information for English language monographs, or really monographs for which the catalog can be printed in the Roman alphabet. This would mean German, French, Italian, Portuguese, and Spanish also. So here is the extension of Marc.

Marc will come out weekly. It appears that the potential is about 2,000 entries per week. It will come to the user on a little reel of tape which the user can do with as he pleases. The tape can be used to retrieve cataloging copy, it can be used to produce selection lists, or it can be used to print book catalogs, catalog cards, any number of things. The limitation is only in the mind of the user. The service is projected to start in October, 1968, or November for sure.

There are always problems, I think, with these machine systems, and one of them, of course, is getting this information in machine readable form. Somehow the Library of Congress has to gear up to do this, and they are doing this now. There's a time of training and preparation for this which is going on right now. But it appears that the problems of generating the main record, recording the information, the flow of work through the processing divisions, and this sort of thing, have all been worked out. L.C. appears quite confident that this project will finally go on an active basis and that Marc II will be openly available to all libraries late this month or early next month.

There is a fee involved. There is always a fee for everything because L.C. has to recover money. The cost is $600.00 a year. This may sound pretty steep until you figure the number of records you get for this money. At the optimum frequency, issuing 110,000 cataloging records per year, they figure it's something less than a penny a record. Now I don't know of any libraries that can have proof sheets for a penny a piece as you must go through them, file them, retrieve, and maintain them. Also I don't know of many libraries that can order L.C. cards or identify L.C. card copy for this money. So when you compare the cost of Marc records to the printed card records and maintaining them the cost is rather attractive. That $600.00 is really just a token cost when you consider the ways that this record can be used.

The Marc II record is a very sophisticated record, sophisticated to the extent that the most sophisticated user would want it. This means that the less sophisticated user may benefit from it or even may overlook this sophistication to provide very simple catalog products. The representation of characters is good old upper and lower case. This has always seemed to be a big stumbling block. We have computer printers and somehow they only print upper case, and we have key punch machines which only punch upper case. So here is the Marc record in upper and lower case letters plus the extent of characters that all catalogers desire. I realize that we have so many books that require extra characters. One of the requirements seems to be the Icelandic form, because we get so many books in Icelandic. It always amazes me that we talk so much about the extended character set we need for cataloging because so many of us get along with a typewriter that doesn't have all these fancy characters and end up drawing things in by hand. So on a Marc character set there are about 126 characters which is more than you can express on a typewriter. I'm hoping that this will be more than adequate for users. They will, of course, encounter problems when they take this to their computer printer because good old computer printer will only be able to represent 48 or 60 or 120 characters. The day of the impact computer printer with a limited character set is going the way of the dodo bird, I think. In our laboratory, for example, we have a computer which will print anything. It will print in a single line Roman, Persian, Chinese, and Hebrew if we want it to, at 6,000 lines a minute. It will justify the lines and the pages, set bold face and italics, all this sort of thing.

These graphic arts printers are coming; indeed, they're here. In fact, they are at the Library of Congress on which printed cards for your new books will be produced starting next year. There will be no more printed cards stored in little drawers down in the catacombs or anything like that. The new cards will be printed on a video composing device, untouched by human hands, packaged in plastic and sent on their way to you on demand. This is dependent on the generation of the Marc tapes, though. People can still have the printed cards. There seems to be a feeling that because L.C. is generating these Marc tapes that people that order catalog cards are not going to get them anymore. But they will. That's the way they'll get them, and much faster, and they'll be hardly able to tell them from the good old type set catalog cards.

The other thing, of course, is proof sheets. What if there is no need to set type for proof copies anymore? The proof sheets will still be coming out; they'll be set on the video composing device and run off as proof sheets. But it seems to me that if the basis of the video composing device is the Marc record, then hopefully while this video composer is composing the proof sheets that this same day the record is going to be on the way to libraries around the country and indeed around the world. Hopefully, then, we'll start getting catalog data in advance of the proof sheets themselves. I think this is becoming more and more of a problem in libraries. So many libraries are getting their books so rapidly because they're on approval plans, for example. They're getting their books in essence at the same time the books are going in the door at the Library of Congress. You know that if the Library of Congress gets the book at the same time you do they really can't have the cataloging ready for you by the time the book comes in your door. This is a real problem. The book dealers then are creating this problem for you. Hopefully, then, we can cut down some of the time lag by using Marc.

I'd just like to say a couple things about Marc. The more sophisticated now say that they are going to get the Marc tape, put it on the computer, and print all their catalog cards this way, week by week. This is entirely feasible. The still more sophisticated people say, "Tape, you know, that's old stuff. We're in the third generation computer now. We're going to put the record on the disc," and get direct access." The real problem arises that with this number of records it looks like we're going to need about 6 reels per year to store these records. This means that we would probably need 12 to 14 disc packs to store these records. So it makes a difference how the library approaches this problem, whether they are selective in managing this Marc input or whether they simply gather it all together much as you might proof sheets. I know there are some libraries that file every proof sheet they get. I don't know why. Some don't really ever throw them out although this same information is reflected in the National Union Catalog volumes that they buy.

One of the nicest things for a library is a good way to manage the proof sheets. Sometimes proof sheets become unmanageable, and sometimes we go to the National Union Catalog for cataloging. I think this is one of the problems we have. How do we manage the Marc file? This is one of the problems that the Library of Congress does not really intend to help anybody with because they can't. They can't tell anyone how to run a library. They can't tell them whether they should have catalog cards printed in upper and lower case letters or in upper case only. They can't tell them how to manage this file. The librarians of the country are being sort of turned loose on their own to do what they please, what they will with this information. I think this is a great thing because now, you see, we are being forced to think of what we really want. We are being forced to define the objectives of our libraries, how we should be giving library service, what we should be doing with our catalog cards.

Should we be letting the computer print our catalog cards? Should we be taking advantage of the computer to generate sets of cards printed ready to file in sequence? This is certainly possible with something like this, and it's certainly inexpensive, in comparison, anyway to the cost that you might find in serving the same multi-catalog environment with people and typewriters. If most libraries have the problems that we do, we have difficulty finding people who enjoy filing catalog cards. You know, it's a funny thing--applicants come, we hire them, and I don't know if we don't tell them they are going to have to file the catalog until they get there or what but it seems like almost as soon as they can they transfer to someplace else. Then we go back to training someone else to file the catalog. This costs money. It costs money to file catalog cards. There is also this business of arranging the catalog cards to be filed--maybe the computer can do this. There's also the problem of making up these sets of cards, and there are many ways to approach this. There are other products as well that we have never had that are now available, and I think they are limited only by the imagination. Book selection lists--we can get lists arranged by subject--chemistry, history, philosophy, physics, this sort of thing--to send out to our people who are doing the book selection. It will give them a tool.

And when they select a book off this list what does it say? It says that the catalog number is here, and when the book comes in we can catalog it and put it on the shelf as rapidly as possible.

Another thing that we have here is a cataloging aid. We get publications in series that number 350 or so at the last count, each volume with a different author. Sometimes I think the best way to find the cataloging is by the series because this may be the best defined information you have on the title page, especially with the Anglo-American code which now says, "enter it the way you feel like entering it today". It raises its own problems. What if you are able to have a list of the monographic series cataloged in this file and find the cataloging for the thing at hand. Here, then, we have the ability to do this.

Another thing I might mention is this--sometimes we get a faculty request that is rather vague. He sends it in with the third author or wrong title, this sort of thing. There really should be some way to do searching automatically in some meaningful fashion. One of the Marc participants at Rice University has been working on this problem. He thinks that he has a way to do duplicate checking at about a 90% accuracy level. This is what he says, anyway; I don't know. Certainly this is one of our problems in libraries, this business of finding out whether we have a book and also retrieving the catalog information for the book we have.

The ultimate problem comes out, of course, that L.C. does not provide cataloging for every book we buy. What books do they provide cataloging for? The easy ones, right? Do you ever find cataloging for the hard ones, the thin esoteric publications that sit in the cataloging department for weeks on end until you finally break down and have to catalog them? And I don't know if the thought has ever occurred, but somebody else has probably had to catalog these too. What we really need then is some sharing of cataloging. But this is rather impractical if you look at it from the basis of mailing the cataloging in to the National Union Catalog or somebody for they may get, for example, 5 entries (5 contributions) for the same title on one day as 5 people have had to catalog it. And I wager that all 5 will be done differently, although this doesn't really matter. The problem is that you need something like an airline reservation system, some way that you can ask some central data bank if there is cataloging available for this, some way that the central data bank will take care of these tapes for you so that you don't have to accumulate them any more and build up reels of tape. What we really need is an inquiry system where you can inquire from a central data bank if the cataloging is available. You'll get it if the cataloging is available and if not you can sign up to catalog it. Maybe someone else has signed up to catalog it, and if so you can leave your name and when the cataloging comes in it can be sent off to you. This way you feel that book by book you make decisions on books in the cataloging process as they come along. If the cataloging is available you catalog the book then. If the cataloging is not available then you have the option to sign up for it. You are going to have to catalog it anyway if the cataloging isn't available, aren't you? Sure you are, so if you catalog it you might as well tell the system you are going to and contribute the cataloging when you get done. When you pick up the next book you may find that someone has signed up to catalog it, so you can put that aside, confident that the cataloging will come to you.

Now what I think I hear in a sort of undertone is this, "Well, maybe the University of XYZ will catalog it, and you know they aren't too good at cataloging, you see." Isn't cataloging really an independent sort of thing? I sometimes think that there's an aura of mystique or great competence because something has been cataloged by a cataloger at the Library of Congress. It's not so; cataloging is done by people and indeed the same person may catalog something differently next month than they did this month. Ready-done cataloging is something to base the cataloging on in our library. This is what we do--the surgery starts when we get that card copy--we change the call number. We change the cutter number. We change the subject headings and the put out a record that is tailored to our library. Even if we don't tailor the good old L.C. record right there, we can print sets of catalog cards; we can print the subject headings on the top, tracings and this sort of thing. We can print them in bold face, upper and lower case and anyway we want. This Marc record is a very flexible device. It's a very flexible way to get your proof sheets and not have to go through them by hand and read them. It's a very flexible way to produce printed cards either singly or in sets. It's a way to make information machine readable so that you can read it on one of these cathode-ray-tube consoles or play it back on a typewriter to assist the catalogers in doing the cataloging they have to do. It's also the basis for, hopefully, a larger system in which we can have a truly cooperative system of cataloging so that somewhere in the United States only one person has to catalog a book and the rest of the libraries can share in it.

The Marc is going to start up, as I indicated, later this month or early next. The test tape is available from L.C. for those who want to play around with this and get their systems going. I hope not everyone in the country will subscribe to Marc right off the bat. I think there's a danger in this. People get these tapes, put them in a little pile in the librarian's office where they gather cobwebs. It can be a status symbol you know. "Are you getting the Marc tape?" "Yes, sure, we're getting the Marc tape." And maybe people hesitate to ask the next question which is, "What are you doing with them?" And the answer many times will have to be, "We're stacking them in a corner."

Marc is a very sophisticated way to transmit information. It's a very sophisticated product, and good old L.C., you know, is pushing you out from shore now and saying it's up to you to develop the programs and systems to use this information; it's entirely doable; it's a very nice format.

The other thing I would say about all this is: just because this is the format in which information is arriving in your library, don't think that this is the format you must keep your book catalog in. This is a mistake that I think is predicated on the years that we have put L.C. cards in our catalogs. If L.C. put it out in this format, by golly, you know that's the way we have to do it in our library. This is a communications format. It is designed to communicate information between users. It's not really designed to store information. Indeed, if the truth were known, the Marc record at the Library of Congress is not stored in the Marc format. It is stored in a format that is easy for L.C. to mainpulate, and it is translated into the Marc format for transmission to all the users. It is a good transmission format. Hopefully, then, the users will restructure this information to be responsive to their needs and their libraries and use it effectively this way.

I hope that you will see the merit of Marc and that you become able to use the information or perhaps join with other libraries in using it. You neddn't feel any hesitation to do this. Let me say, too, that PL-1 which is the language that we have been using in our library and which, incidentally, manufacturers are beginning to start writing for their machines--RCA is one that we know of, is really a very fine language for manipulating this. We've had good success and have been using it since before it was officially released. In fact all of our library's programs for the 360 now that we have converted from the 1401 are written in PL-1, and we've had very good success with it. Thank you.

PANEL SESSION:

LIBRARY PROFESSIONALISM

VIS-A-VIS THE COMPUTER

SPEAKERS:

Moderator: Prof. Molete Morelock, Coordinator of Regional Campus Libraries, Purdue University

Panelists:

Professional Implications for Library Personnel - Prof. Molete Morelock

Improvement of our Opportunity for Information through the Computer - Prof. John T. Williams, Head of Reference Services, Purdue University

Preparation of a Film Catalog - Prof. David Moses, Acting Director, Audiovisual Center, Purdue University

Public Relations Problems of a Machine Circulation System - William H. Richardson, Supervisor, Research Library, Allison Division, GMC, Indianapolis

Institutional and Administrative Problems - Prof. John H. Moriarty, Director, Purdue University Libraries

PROFESSIONAL IMPLICATIONS FOR LIBRARY PERSONNEL

Molete Morelock
Coordinator of Regional Campus Libraries
Purdue University

In our panel this afternoon we are making every effort to be down-to-earth and practical. At Purdue we have spent a long time working with the serials catalog. We are now getting results, but we're not like the Indiana and Purdue football teams---everything hasn't been roses. This afternoon we are tryigg to look into some problems and some breakthroughs. Professor Williams, head of Reference Services, will speak about some hopeful aspects as far as reference is concerned. Professor Moses of the Audio-Visual Center will tell us about his work with the film catalog. Mr. Ricahrdson of Allison Division, General Motors, Indianapolis, and President of local chapter SLA, will talk about his circulation system. Don Hammer, who is in charge of Library Systems Development at Purdue, was called out of town and couldn't be with us, but he left some print-outs and a representative. Mr. Robert Mount, who is working on the serials programs, is here to tell us about the status of the State Union List of serials. Professor Moriarty of Purdue will tell us something about costs and administrative problems.

Many articles that have been written on computer applications in libraries give plans and projected progress. We have had very few summations or reports of progress. We probably all read about Florida-Atlantic that the whole library was going to be automated. We have heard little from Florida-Atlantic in the library literature lately.

Professor Frederick Kilgour at Ohio College Library Center has ambitious plans for a cooperative computer based library operation. With Federal backing this may have better prospects than some other projects. It sounds very good in the planning stage.

Many of these operations fell down because of programming difficulties. Could it be that we librarians have expected programmers and systems people to learn enough about librarianship to plan and program a system that would work well enough to supersede the processes we have been rather unconsciously using for years? It seems to me that librarians should become much more intimately involved in the revolution, as it may be called, in librarianship. The computer itself is an inanimate object. By means of electrical connections it can say "yes-no, yes-no, yes-no" a million times and do it much faster than any librarian or any library clerk. But unless definite and clear plans are made and minutely detailed programs are written, the computer has no way of knowing whether to say "yes" or "no", or what to say it to. First let's take the programmer. He has finished high school and has had perhaps two years of college. Does he know enough about librarianship to tell the computer what to do about library problems? Next is the systems man, the bright young fellow who draws flowcharts and hangs them on the walls. He probably has studied industrial engineering and this is a good subject. We teach it at Purdue, and we have seminars here with the Industrial Engineering staff. But industrial engineers know very little about librarianship, unless they work with librarians. Our engineers have worked with us for several years.

Flowcharting, after all, isn't very complicated. You use a rectangle ▭ for processing. You use a trapezoid ⏢ for input-output, an ellipse ⬭ for a terminal, an arrow ◄ to show direction, a diamond ◇ for decision, and ⬠ as an off-page connector. These symbols are used for systems flowcharts as well as program flowcharts.

The main object in drawing a flowchart is to analyze our operation and ask ourselves, "is this step necessary?" It is at this point we librarians should be able to keep what is good in the old and adapt what is good in the new. As somebody said, if our procedure is already a mess and we put it in the computer, what we get is just a fast mess.

One cause of delays in computer applications has been lack of "documentation." By documentation in this sense we mean all the planning, coding, flowcharting of the system and logic charting for the programming. This, as well as the programs themselves, should be a definite part of the write-up of any computer application. These could be easily transferable from one employee to another. In many instances each library has tried to more or less re-invent the wheel. In the past some of this experimentation was necessary. Now, however, we are getting some standardization and some applications that hopefully can be used by any knowledgeable literature scientist. ASTM has now come up with CODEN[1] for periodical titles. It does not cover all periodicals but is a step in the right direction and it would have been very helpful had it been available when Don Hammer started the Purdue periodicals project. Now with MARC II there is agreement between Library of Congress, National-Agricultural Library and the National Library of Medicine for a communications format. MARC I was used on an experimental basis by several people, one of whom is Mr. William Studer from Indiana University for selective dissemination of information. MEDLARS is a good example of a system that has had wide application. Mary Jane Laatz has been a part of this network and has given service to the medical profession in this area.

In the field of programming, General Electric has what they call a "Public Library" of basic routines. IBM has SHARE which includes not only programs done at IBM but some programs that have been made out by users. Now there is LOCATE, Library of Congress Automation Techniques Exchange, SCOPE, Software and Computer Program Exchange, and USASCII, U.S.A. Standard Code for Information Interchange. The whole field is rife with acronyms. Maybe you haven't heard of ACORN. That stands for Acronym Oriented Nut.

It was Joe Becker, Director of Information Sciences Research at EDUCOM, who said that he thought MARC II was the most valuable breakthrough in librarianship since 1902. I am not sure that MARC II itself will cause a complete revolution in librarianship, but I think good use of computers will eventually cause one. There have been many failures in computer applications to libraries, but none of these will make the computer go away, nor will they lessen the progress of the data banks. Speaking of data banks, we have a list that may be new to some of you: Inventory of Available Data Bases by Joan C. Troutman[2]. The slow progress of Librarians in this field will not lessen the potential of the computer's usefulness in taking care of and recording recurring minuitiae.

I attended an institute on computer based library information systems this summer at the University of Missouri. There were 29 librarians from 21 states. Many participants were new library graduates. They had been out of library school only a few years. Some of them were good programmers before they came, and all the others were working at it with a will. Two librarians had so much skill in the field of programming that they were pulled out of the group to work on a special project. One librarian did such good flowcharting that it looked professional. Associating with this group gave me the feeling that librarians can get acquainted with some computer applications probably in much less time than computer people can learn librarianship.

At this stage we are not naive enough to say that miracles will work themselves or that computer based information can be tapped with no expense. If librarians become more actively engaged in computer applications, this will be a big breakthrough.

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IMPROVEMENT OF OUR OPPORTUNITY FOR INFORMATION THROUGH THE COMPUTER

John T. Williams
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I'd like to start on a general note which is illustrated by a joke I came across recently.

A father was telling his sons for the 50th time his most glorious World War II adventure. "There we were," he said, "trapped, corned like-rats, surrounded by 80 enemy soldiers."

"But Dad," interrupted the smallest of his three children, "last year you said you were surrounded by only 40 enemy soldiers."

"Last year," the father continued, "you were too young to be told the whole truth."

I think this story has pertinence for us in our approach to automation. I think that in the past it was assumed that we were too young to be told the whole truth about automation--about its problems and failures as well as about its successes. But I think the climate has changed. I think this is illustrated by the more realistic appraisals we are receiving about what we can expect from automation in the near future.

This more realistic approach is revealed in some of the recent literature devoted to library automation, not only in the more technical articles but also in the articles appearing in our more general library publications.

As an example I'd like to cite two articles that have appeared in Library Journal and which I'm sure many of you have read. One is an article by an Australian Librarian, Harrison Bryan.[1] Bryan describes a special tour he made of the United States to inspect a number of automated installations that he had read about in our library publications. He goes on to describe in some detail how disappointed he was to find that many of these installations were not operational at all but were still in the planning stage.

A second article, by a Canadian librarian, Stuart-Stubbs[2], is a humorous account of an attempt to automate a hypothetical university library and the hopeless confusion that results.

Stuart-Stubbs is quick to let us know that he is not anti-automation. He says, "Library administrators cannot shove automation under the carpet. If the administrator is not doing something about it, or if he doesn't explain why he isn't, somebody will probably do something about him."

But he does have some advice for library administrators contemplating automation. These--"morals"--as he calls them, include: "The evil man key punches lives after him." "Beware the unprogrammed programmer. It takes a lot of time to write programs, to test them and to eliminate the bugs. Make sure you have generous amount of programming time before you begin anything."

One of the characters in Stuart-Stubbs' article is an expert from a computer company. The author cautions us to view with a jaundiced eye the advice of such experts saying, "The first mission of a good salesman is to sell. Experts they may be, but experts with a motive."

Finally, regarding the literature on automation, Stuart-Stubbs says, "Don't believe everything you read;--keep one ear tuned to Shaw, the other to Shera."

Now probably I have spent too much time quoting from an article that is only peripherally related to my topic, but the point I want to make is that I think the fact that we can now deal in a realistic, in a critical, even in a humorous way with the problems of automation shows that we have reached a new level of sophistication that is preferable to the earlier period when we saw only the glowing promises of the age of automation.

I am not, of course, qualified to discuss the technical and administrative problems of automation and the lessons they can teach us. Mr. Moriarty, who is qualified, is going to talk about this a little later.

I think that we can now certainly point to some real achievements in the area of automation--achievements that are doing and will do much to increase the capabilities of the reference librarian.

I don't want to bore you with a lengthy list of titles, but I do think it is a good thing to remind ourselves of some of the worthwhile reference tools the computer has given us.

First of all, we have a whole host of computer based indexes.

In the sciences we have abstracts for the report literature like STAR and Nuclear Science Abstracts. We have a new general index to scientific literature, Pandex. We have the computer based abstracts like Biological Abstracts and Chemical Abstracts. We have Science Citation Index which shows how often an article has been cited and by whom.

We have the capability for literature searches which are being made in a number of libraries and by such commercial organizations as the Institute for Scientific Information and the producers of Pandex.

We have a number of centers devoted to special subject areas. Here at Purdue we have the Thermophysical Properties Research Center. Periodically the center prepares a computer-based index to the literature in this field.

There are already a number of these information centers being developed throughout the country. In the future we will probably have many more of these centers tied together through regional systems into a unified national network. The Inter-university Communications Council (EDUCOM) is working on plans for such a network.

I think one of our most important achievements has been MEDLARS with its computer-based Index Medicus, with the tapes providing additional subject approaches to the material and with demand bibliographies on any subject available to librarians and physicians.

Nor have the social sciences and the humanities been neglected.

The index to that excellent new abstract Historical Abstracts is now produced by computer.

The Human Relations Area Files, which have given impetus to new research effort in anthropology, have their indexes produced by computer.

As in the sciences, many special research centers are being developed. To mention just one--there is the Information Center on Crime and Delinquency which abstracts the literature and reports on current research in their computer-based Crime and Delinquency Abstracts.

I think I should also mention the list of Social Science Data Archives in the United States. In it are noted research centers with computer-based data banks.

A number of these centers will loan the tapes containing their raw data to scholars.

Dissertation Abstracts has recently inaugurated a service which will provide computer-produced lists of dissertations in any subject area.

There are also many worthwhile local projects. Here at Purdue we have a computer print-out of our serials holdings available. This print-out has been placed in several areas in the General Library and in a number of departmental libraries. It has proven to be a godsend to the harried reference librarians who no longer need to call the assistant at the union catalog for periodical information.

These tools represent more than empty promises; they are the tangible results of the computer age.

As for the future, probably one of the most important on-going projects is the Marc project. This project is now entering its second phase. Weekly tapes with catalog information for approximately 1500 to 2000 titles will now be available at the rather modest price of $600.00 a year. Besides providing catalog information, these tapes can be used to provide libraries with lists of titles in any subject area (SDI lists). For this use we are indebted to Mr. William Studer of Indiana University who conducted feasibility experiments with the Marc I tapes.

So it certainly appears--to use an old cliche--that computers are here to stay, and I for one am glad, because, besides giving us all these excellent reference tools, I think it is going to elevate the status of the librarian. That is, if we are careful, as the kids say, not to "cop out."

I think that there are several reasons why we are going to benefit. First of all, we are going to be the experts who will know whether or not a problem calls for the automated approach. Machine time, as you all know, is not free--in fact it can be quite expensive. Who is better prepared than the librarian to decide whether a question can be answered by using the World Almanac or by making a rather expensive machine literature search?

And won't the fact that we are arbiters who make these decisions enhance our status?

Secondly, we are going to have to play an important role in educating and encouraging people to use these new tools and facilities. Surveys have indicated that researchers are often quite unsystematic in their quests for information. Often they seem to place their principal reliance on information received from friends and colleagues, and this includes scientists and engineers who might be expected to be very systematic and up-to-date in their search for information.

This problem was noted in the famous Weinberg Report[3]. Dr. Weinberg deplored the lack of bibliographical know-how on the part of the graduates of our technical schools, but he held little hope that this condition could be easily corrected in the near future, for he said: "There are too few professors who are themselves sufficiently knowledgeable in the use of the literature to be able to teach the modern techniques effectively."

So I think this is the second way in which the role of the librarian is going to be enhanced by the age of automation. We librarians are going to have to teach our public how to make use of these new tools. This will be true if our patron is a housewife or if he or she is a person with extensive technical and scientific know-how.

Besides being the arbiter who will know when the computer should be used and the educator who will help the patron to know how to use the new technology, there is still a third area where the librarian must play an important role and one which can not help but add to our status. This is the area of automation goals or the question of what we are going to automate and why.

A few months ago I attended an institute on library automation at the University of Maryland. Paul Wasserman and Mary Lee Bundy spoke to our group during one session. Their main thesis was "What is the point of automation if we are simply going to automate the same old inadequate library processes and procedures." The response by the participants to this point of view was immediate and hostile. The librarians were annoyed but the systems people were positively furious. Now I think Wasserman and Bundy were doing this with tongue-in-cheek, but I believe that they had an important point to make--namely that we really need to know a great deal more about what our user's needs are--not surveys about their age, sex, socio-economic background and ecological patterns but rather about what they want to get from the library. And who is in a better position to help answer this question than the librarian? So I think this is a third area where we reference librarians are going to play important roles. We may or may not be involved in the actual surveying process, but we are going to be needed to help frame the important questions and interpret the results. And once the needs are articulated, we are going to be needed to help formulate the many big and little plans that are required to satisfy these needs.

So I'm convinced that this age of automation is going to provide us with a bright future, one that will make our jobs more interesting and enhance our status and prestige. So let's not be afraid of the computers, for as someone has noted--the human being, the human computer, enjoys three advantages over the mechanical computer. The human being weighs less; he requires far less energy; and he is the only computer yet designed which can be produced entirely by unskilled labor.

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PREPARATION OF A FILM CATALOG

David Moses
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There are a number of reasons that the Purdue Film Library decided to computerize some of its operation. First, we felt that this was one way we could improve the services which we offer our faculty and students. Second, we knew that once the computer system was in operation it would be relatively easy to keep our cataloging and inventory information up to date. Third, we knew that with our size collection, about 3000 motion pictures, 2000 filmstrips, 4500 tape recordings, and 1500 other items, we were not so large that we needed a computer to do the work but knew that with each year's growth the problems would be greater. So why not get started now!

The audio-visual field lacks the experience and research in cataloging that the book libraries have and each library seems to be using a different method of processing. So it was no surprise to us to find little information on entering our data into a computer system. At the time we started working with the computer, about the only working computer cataloging for audio-visual materials was the program at the University of Southern California headed by McMurry. We talked with him about the possibility of using their data but found that we had a rather strange collection of titles in our library. So following true Audio-visual form, we decided to strike out on our own with our own system. After all, we knew what we wanted, Purdue had the computers, and someone said they had a programmer we could borrow. At this point I would like to warn you about borrowing programmers. We are now working with the fourth one in two years and each one tells us that the preceding one didn't seem to know quite what to do to make a program work. I really think that a good programmer is the key to success in trying to work into any computer system. I also think that we as users must believe that computers and computer programs are capable of storing any information we want to put in and also capable of giving us back our information in any form we want it. We must believe this in spite of what the programmer tells us and insist that we get what we want. Of course, we may have to change our minds once in a while when we get the bill for all of this work, but let's start out thinking we can have anything we want.

Our immediate goal was to develop a system which would store all the information we needed for inventory control and for making a catalog of available materials which could be used by our staff and our customers. The things we wanted to know about each item in our inventory included: the type of material (motion picture, filmstrip, tape, etc.), the title (we don't have or use authors as they are known in book cataloging), a subject matter description of the contents (as short as possible), the grade level of the content, if the material is or is not available for rent off the campus, if the material was purchased by us or donated to the library, if it is sound or silent, black and white or in color, the rental fee that we will charge, how much it cost us, when we got it, the shelf number where we will keep it, how many parts and copies, and as many subject headings as we desire (this is where we would toss in the author-type information).

This is the information we felt was necessary for us to have to give us control of each individual item in our library. It is information that is easy to locate at the time of acquisition but often hard to find several years later. We were even willing to forget some of these items on the older titles in the library if we could just get started now in working towards the future via the computer. We would include all of the information we had on present titles and do a thorough job on all new materials. There are other bits of information which we plan to include, most of which can be stuck in here or there without changing our programs which seem to be headed for success.

As we proceeded, we found out that getting information punched on cards and then onto tape and, so to speak, into the computer is no problem at all. The problem comes when you want to get it out. Several interesting facts of life, or facts of machine if you wish, become apparent when you read your first long awaited print-out. First you think the operator ran the wrong tape, second you think that maybe the computer blew a transistor, third the key punch operator must have had long fingernails to type like that or maybe the cards were not verified at all. Or maybe there was a reason for that so-and-so to be so willing to let you use his programmer. Last of all, and it may take months, you ask yourself if maybe you didn't give the computer people the correct information in the correct format in the first place. And if your first print-out looks that bad, as ours did, I think you will find that although there are many places along the way to make mistakes the easiest place is in the beginning. There is no substitute for correct information in the correct format to be handed to the key punch operator.

As would be expected we wanted a number of different readouts from the input information so we asked the programmer to set it up so that we could print-out according to the following requests: type of material, title, grade level, source or vendor, date of acquisition, shelf number and subject headings or any combination thereof.

Although the work has been much slower than I would have liked, we do have useful print-outs which we are using in the Film Library, the Regional Campus libraries and some of the campus branch libraries.

A sample of the input sheet that we are using shows how we give correct information in the correct format to the key punch operator. This is a far cry from the pencil corrected 3 X 5 catalog cards that were first used and helps insure correctly punched cards which are one of the real keys to success.

The first readout we wanted to see was one which we will label with a film production term called "answer print". We wanted to see if the computer could, by type of material, give us an alphabetical listing of materials which would include everything we knew about that title. This answer print also gives us our inventory control information. Our answer print is about two and one-half inches of computer printout paper and lists almost 3000 motion picture titles.

After asking the computer to remove all of our in-office information the print-out shrinks to less than one half inch yet lists all of the information normally needed by our customers. This is used in connection with a small eighth inch thick print-out of film titles listed by subject, all of which is supported by a mere four pages which list the subject headings we have used to date.

With our volume of acquisition we will up-date once a month or less often depending on the number of new titles. Later when we add other items besides motion pictures, we may require more frequent up-dating.

At the present, then, we have several printouts which will help both our customers and ourselves. We also have the capability of providing our customers with special readouts designed by them to fit their needs. We have good inventory control information and in the near future will use the computer to print a book catalog of films which we circulate. We have a system to which we can add an almost unlimited number of items in a wide range of types.

What do we want in the future? We want a real time inventory control system so that any user can find out what we have down to the last few days acquisitions. We want our booking and scheduling of materials and equipment on line using time sharing so that they may be scheduled from any one of many remote computer terminals--even ones not located in the library. We want a service that is so easy to use that it makes it hard for the faculty and students not to use available learning materials.

PUBLIC RELATIONS PROBLEMS OF A MACHINE CIRCULATION SYSTEM

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I was searching for a subtitle that would emphasize what this paper is about. This is it: "How to avoid having angry borrowers demand 'Why am I getting a fourth overdue notice for a book I never heard of'?"

Some of the reasons for adopting a machine circulation system are: (1) It probably gives the library better control of its materials than the old manual system did, (2) It saves time for the library staff so that they may give better service in other ways, and (3) It makes it easier for the library user to charge out and renew books. Inherent in each of these objectives is a concern for better service to the library user.

Now if the library user is going to get better service from a machine system, it has to be well designed and operated with a minimum of errors. The first thing the librarian has to do is make sure that the programmer understands exactly what the system should do and what kind of information the system will be handling. We are assuming that the librarian knows something of the limitations of automatic or electronic data processing equipment. And certainly any programmer worth his salt will tell the librarian what can or cannot be done.

Whatever system is used, it should be designed to meet the requirements of the particular library situation. For instance, we wanted to be able to produce a list of all the materials a person had charged out. So that requirement ruled out photographic charging. We also wanted to be able to tell where a particular book was at any time. In case a person needs to look at a book in a hurry we could tell him where it was and he wouldn't have to wait for it to come back to the library. This meant that we kept our book cards filed by author, as we had before, but transferred the information to punched cards. In any circulation system there are three types of information that have to be correlated--the book information, the borrower information, and the loan information. The book information includes the author, title, and book number. The accession number can be used as a convenient tag to identify the book and pull out the full book information once the full book information is put into the system.

The borrower information includes name and address. There are various ways this information can be put into the system. If the borrower has an ID card with an embossed number this number can be imprinted on a transaction card. Even if the borrower doesn't have an embossed ID card, he may have an employee number that can be written on the transaction card. In our case, however, the employee number was subject to change whenever the employee moved or departments were reorganized. So the employee number wouldn't work. We even considered using social security numbers or the Midwest Bank Card. These had obvious disadvantages. So our borrowers have to write their names and our machines have to search by last name and initials to print a list of books that are out to one borrower.

The loan information includes the due date, and the term is generally meant to include both book and borrower information also. All of the information has to be brought together on an overdue notice. I have had experience trying to use an overdue notice that did not include the title, and it doesn't work. The borrower usually will remember a book better by title (and therefore subject) than by author alone. Of course, he will remember it best by both author and title, so that is what we use.

Once the programmer has gotten all the information he needs from the librarian, he will write the machine program. Then he will write the rules for the machine operators. It is expected that the programmer will write into the machine program and the instructions a series of checks so that there will be a minimum of errors. When this is done, the system is ready to be put in operation, but it is wise to have a trial run first to see if it will perform the way it's supposed to.

Before and during the trial run is the time for training the library personnel who will be responsible for operating the circulation system. This means not only training in the mechanics of the system but also in the purpose of the system, why it was adopted, and a full explanation of the entire system. This training is especially necessary for the library personnel who will be explaining the new system to the library users.

It is important that the system be well designed and operated with a minimum of errors so that the library personnel can have confidence in the system. For it is the library personnel who will be interpreting the system to the library users. There is always a tendency to blame errors in the system on the machines. We have all seen cartoons and heard stories about foul-ups perpetuated by computers. And yet we know that the probability of human error is much higher than that of machine error. So if your machine circulation system sends out overdue notices like the one described in the subtitle of this talk, you know who is to blame. It is the librarian or the programmer, the library staff or the machine operators. A quotation from the Pogo comic strip is appropriate here, "We have met the enemy, and he is us."

INSTITUTIONAL AND ADMINISTRATIVE PROBLEMS

John H. Moriarty
Director
Purdue University Libraries

The topic logically will be "Institutional and Administrative Problems of Library Professionalism vis-a-vis the Computer. Actually I have been assigned to talk until 4:00 p.m. or a good closing time on whatever the previous speakers have omitted and am to be sure to put my points up for targets of discussion, especially if the speakers' omissions possibly involve institutional or administrative situations.

To prepare for this assignment I have been roughly grouping my comments in my mind under three categories: money, personnel, and systems. The other speakers will have surely given you generalizations or cases which fit or illustrate these headings and my comments will merely emphasize such, but hopefully even with these the viewpoint I give will throw a different light on them.

Of course computers involve expenditure of lots of money, and you will have realized this from much already said. How, then, can libraries--which are always on inadequate budgets--have any commerce with these expensive equipment services? Why don't the libraries just buy the more books they always claim they are lacking and let the computers go? Actually in case after case libraries have been offered free time on computers at the start. The fact is that the city manager's office, industry controller's office, or university computer center, when these have been first started on their first or on a new computer have surplus time on it. The reason for this is simple. A new installation of a computer is poorly engineered, indeed, if it is at capacity when it starts. Accordingly an offer is made to a city library, company or special library, or university or college library that one of these may want to make use of otherwise vacant computer time. So the library starts to get its records or data into the computer system and eventually may become significantly involved.

After a time an administrative problem of great moment arises. The computer center gets fully used, perhaps overused for its capacity; a transfer to a new computer with more capacity may be delayed; and the library finds its welcome worn out and its time on the computer constricted. This can bring on a real library and institutional crisis. The solution is purely administrative. The library staff has to submit to a review of its needs,an evaluation of what contribution its computerization makes to the institution, and sometimes a straight dog-eat-dog institutional battle for a share of computer capacity.

It is in this last stage that the men get separated from the boys. If a true study, comparative and rigorous, of what the defensible computerization of library operations has not been made, in advance if possible, or certainly as the step by step computerizations have been effected, the library can be in real institutional trouble. Professor Ferdinand Leimkuhler, of our Purdue Industrial Engineering staff, has repeatedly counselled: "Do your operations research first, then computerize what is best done by computer; don't computerize and then try to defend the decision later." This is a counsel of perfection, of course. There is a prestige to computerizing, and librarians are very vulnerable to the need for prestige. As service people we want to be thought "up-to-date" not "fuddy-duddy." So in the decision to go into computer services, what is needed by library administrators is a hard-nosed practicality, and if this means being called conservative, then let us accept that label. In practice, what is the best procedure is gradual or step-by-step computerization, laid out for a five or ten year plan, where every step is related to what has just been done and likewise to what is to come next. If the University or company or city council has accepted this over-all plan, then the problem of money, which is usually its scarcity, will touch the library, but proportionately with other institutional needs, and not mean the library's elimination from the institution's computer program.

Personnel problems loom large in any library's computerization. And library professionalism can be an often unfaced but actual and active element among the problems. Librarians hate to give up any part of their personal control of the services they offer. Their addiction to clerical duties is a constant complaint about them. The answer given is often: "It is easier to do it myself than to tell someone else how to." While this is usually said with the best of motives, namely superior service, it is not a defensible posture except in the smallest libraries.

But with computer work, we librarians have to tell someone else how to do what has to be done, and we have to tell them just how and in details so elaborate as to be almost unbelievable. As a machine, the stupid computer can do marvelous services, but it can understand nothing. So scarce librarians have to engage scarcer programmers and have to tell all to them. Anybody can forsee that this job is just this side of impossible. Perhaps not altogether impossible, but certainly just this side of it. So if librarians have ever had any character the tests are at hand. One test is the mortification that must be endured when and as we find out that we don't know enough of what we are doing to tell it to others completely. The second test is the patience needed as we follow up on and endure each disappointment that the computer causes. The computer as it stands today simply cannot do what we want it to do. But so great is the confidence, especially of the young professionals of all fields, not just of the library, in the final success of the computer, that they will make it do what they want. And I am sure librarians will be among these demanding future professionals.

Now there has been a lot said about this, but I would like to show you one or two things that have hit me in the last day or two, things that are just unbelievable. For instance, take the Royal Society of London publications; they publish Proceedings, Transactions, A. and B, Obituary Notices, and Biographical Memoirs, and they publish an index. We had it listed as being from 1951 to 1960. I looked in our card shelf list and I found that the Biographical Memoirs were listed as volume 1, 1955, volume 2, 1956, etc., and down there is the index 1951-1960. Well, any computer will tell you there is no logic, your index being for five years that you don't own and that were never published, isn't it true? Isn't that exactly what your card is saying? Well, you know and I know that we librarians for years have seen things like that and never thought anything about it. Another example, I looked at our card for the Atlantic Monthly, and saw the years listed 1880, 1881, 1882, 1783, 1884, and went to the shelf and got 1883 and never thought anything about it since I was busy that day. I didn't go back and see that the card was corrected. Why not? But when this periodical shelf list suddenly turned out to be on the computer we find out we have three or four thousand illogics in it, and my catalogers have always thought they were a very high class of catalogers and they are. They're human, of course, and the machine isn't, and the users are human, and they quickly find their way without a lot of help. They understand, but the computer doesn't and this is what drives the whole staff crazy, including the programmers when they are working for us. I don't blame them at all for the way they feel as you see they are trapped continuously.

Finally there is the systems problem. I have mentioned above the planning needed, but that is an internal library problem. Here I want to discuss the institutional--the whole university, company, municipality--system into which a program of information service of some kind should be fitted. No one person or group should ever have absolute control over how information gets into a university, company, or municipality. Probably no group ever can do so, certainly not librarians. But I have always felt librarians as professionals should understand, better than we up to now have done, how communications flow. As professionals we should be experts in such matters and we should not just concern ourselves with the book. In an institution (university, company, municipality) we should contribute to the flow of communications and be guides and counsellors to the establishment (i.e., the president or mayor, etc.) in how communication best be managed. Certainly there is no need for two library systems in a university, one on computer tape or disc, one in books. People in general whether students, staff, or citizens, with a need to find out published knowledge are entitled to find it basically in one place.

The computer as a manipulator of data is of course a thing apart, but I feel institutions are weakened if their information-retrieval, except for job-specific needs or for specialized groups, has to be sought in two or more places, possibly overlapping and even competing. Librarians should broaden themselves professionally and administratively to handle the maximum span of open information retrieval, be it from books or whatever form. If this means changing our buildings, let's do it. If we have to engage paraprofessionals, such as programmers, we must do so.

There are noble intellectual reasons for doing all this, but I as an academic librarian am specifically concerned. The university of the 1930's, 1940's, 1950's has always been judged primarily on the basis of its strong individual teaching and research

departments. Up to now the one common bond, aside from the parking problem, that a president had to hold his institution together was the library and his support of it. From 1965 onward, however, a second common bond which will want the president's support is going to be the computer center. Faculty and graduate students coming to an institution will want to know the quality of a particular department and of the library, as in the past, but they will more and more want to know of a university computer facilities. If the library and its professional staff are smart, they will join in the new service. It's still the old maxim--if you can't lick 'em join 'em, and you do so, whatever the problems encountered in getting the computer into your system.

INDIANA LIBRARY SERIALS DATA BANK

Robert Mount
Library Systems Programmer
Purdue University

For those of you who have had no previous contact with the State Serials System, I would like to give you some insight as to how this all came about. Library Systems Development of Purdue University is currently engaged in a project entitled "Development of an Indiana Library Serials Data Bank." This project is under the direction of Professor Donald Hammer who, as Miss Morelock noted, is not able to be with us due to a previous engagement. The sponsoring agency for the project is the Indiana State Library, and the funds are being made available under the Library Services and Construction Act, PL 89-511, 1966, Title III. The concept of such a system was the consequence of meetings between Purdue, Ball State, Indiana State, and Indiana University. These four libraries realized the need for a serials data base to assist them in interlibrary loan functions and user reference services. The project has grown considerably since then and now plans to include 53 libraries in the state and we hope will cover almost every type of special library that wants to participate.

The need for such a data base has been established among users of union catalogs and, in fact, several libraries have already devised book catalogs for their own use as well as distribution to other libraries. When I refer to a book catalog, I am not necessarily referring to a computer listed page, since some of the catalogs now being printed are typed. Regardless of the original form, the exchange and wide distribution of these book catalogs is worth noting. It is extremely helpful to have access to other libraries serials holdings without having to leave your own library. Although the major use of the catalog is user oriented, the benefits that the libraries will receive from the system are innumerable. Not only are the patrons of the libraries finding these catalogs useful, but the libraries are using them considerably in the exchange programs.

Those of us working on the project hope that this will be only a beginning step toward an interstate or national network. The information that we are collecting now should never again have to be collected, but could be easily converted from the state system. Of course it is hoped that the first printing of the catalog will not be an end in itself. The system is designed to be updated easily and it is hoped that regular supplements to the catalog would be published as well as a new catalog when enough changes have been made in the original catalog to warrant it. The catalog will be produced on a 1401 chain printer and will be reduced before it is duplicated. Some of the more obvious uses of a state catalog would be (1) interlibrary loan functions, (2) improved collections by the merging of partial runs, (3) it would help in cooperative buying and storing of the serials, (4) and it will provide an excellent reference service to its patrons.

Some of the "extra" features that would be available through the computer are lists by (1) subject (2) or by language, (3) a call number list, (4) or a list of translated titles all of which could be easily produced. All of the lists would be available for a specific library, as well as a title list for each library. At this time I can't guarantee that we will be able to provide all of these runs on the funds that we have. But once the programs are running it is only a matter of covering machine costs, which are nominal.

The design of the system is certainly unique but we are not attempting to set a magnitude of new standards in library automation. New Serials Titles and Union Lists of Serials are used as an authority on titles and bibliographical information: MARC codes are used for language and country of origin codes. Ulrich's and other printed sources are used as our authority on our subject headings. So you can see that we are incorporating into this system many established standards and are establishing very few of our own. Format is the only specification that we are particular about, and this is not because we are extremely particular but the computer we are now using, an IBM 7094, appreciates it if we are consistent.

The elements to be included in the data base are definitely more than are necessary for a union list by title, but this enables us to use the files for some of the previously mentioned listings such as a list of translated titles by call number, or any printed sequence that we wanted. These extra data elements should not be too much extra work for the participating libraries, with the exception of Indiana University, which has agreed to assign the subject and language codes for us. Among the data elements in the file are the (1) corporate entry (or title), (2) the publisher, (3) the ASTM CODEN, (4) subject, language, country of origin and translation codes, (5) bibliographical notes, (6) location call number and holdings statements and (7) x-ref tracings (which are automatically entered and updated by the processor). These are the basic data elements that we feel are important. Of course if any of these elements prove that they are not as useful as we had thought they would be, we may always delete them. Adding new information at a later date would require considerable effort.

If you have any questions that I am not able to answer, or if you would like more general information, please feel free to contact Professor Donald P. Hammer, Head of Library Systems Development, Purdue University. Our zip code is 47907.

QUESTIONS

MR. MORIARTY: If there is anyone present who would like to ask a question of the panel or anyone else, feel free to do so.

QUESTION: Management of all this information that we have machine stored becomes a bigger problem when you consider who can look up a record. There is a feeling that if the librarian decides who has access to the information in the computer, whether or not a certain person can look up information, we get back to the old problem of a kind of censorship with the reference librarian being the censor. We've been trying to eliminate the old locked cases and things like that of recent years. Could Mr. Williams comment?

MR. WILLIAMS: This question occurred to me as I was preparing the talk. I really didn't attempt to deal with this, but I suppose we are going to be placed in this position as authorities and experts in a sense. We will determine how we're going to search for answers, how we are going to approach the problem. I think we're going to have to be very careful about this. It's going to call for a lot of discussion pro and con.

MR. MORIARTY: It seems to me it's a matter of money basically. I've always realized, and I think everyone does, that we won't tolerate censorship of any kind in our libraries if we can fight against it. But the censorship with the dollar is always there. It always has been and always will be. This will be a question of whether this person, either by his position or by his utility to the institution, will have access to the information. If we feel his question is trivial we'll have to say "no". This is an unsolved problem of our time now, too. For instance, when I go out on the floor and a sleepy-eyed lad walks up to me and says he wants something on cancer and it's about 9:10 and I know he is going to a 9:30 class, I give him the Americana. I made the decision that this is all he needs for his speech on cancer. Now if a fellow in his early 30's comes up to me and wants to know something about cancer and I have seen him around a lot, I might take him over to the Index Medicus to start him off. I might give him a good deal more of my time. You see I am managing the cost of the thing. I wish my staff were always doing the same.

QUESTION: I agree that this is the mark of the true reference librarian. He makes decisions and manages things properly. But with books available you usually do not deny the patron access. With a machine you might.

MR. MORIARTY: Are you throwing all the books out the door? No. But if you're talking about the future, this is a possibility although I'm not suggesting it.

MR. WILLIAMS: I think I was making the point that Mr. Moriarty made and has done a better job of. I think we'll have to make a decision in terms of who the patron is, the amount of information he wants, and use the appropriate tool. Of course this does give us some power, admittedly, but I think this will do something for professionalism in library science, and I think it will elevate the profession, give us more status.

QUESTION: In regard to this program that you have underway in the state of Indiana, is this federally sponsored?

MR. MOUNT: Yes, the money is from public law 8511. Money is coming through the Indiana State Library who is dispensing the funds to us.

QUESTION: When is the list to be completed?

MR. MOUNT: We hope to have the first list within 9 months from now. I don't think the problem will be trouble with the system as much as it will be how soon the libraries cooperating can get the information back to us. The reason we don't anticipate much trouble with the system is that we're basing it on the automated serial system that we already have here at Purdue. It's a very good one, all debugged. We may run into some "garbage in - garbage out" problems, but I hope not too much. By next summer we should be printing the first book. There are to be supplements after that, but we don't have the money for them yet.

QUESTION: Since I have a proprietary interest in the development of the Indiana serials list that was described here this morning, I want to ask about restrictions on it. I understand that the details of it are relatively restricted, and I can understand that since you are basing this union list to a great extent on what you have already done at Purdue. Is the information that is going in it really going to be restricted, despite the fact that the work is being done under federal grant?

MR. MOUNT: No, the information that we are to put into this will not be restricted in any way that I can think of. We don't want to include things like daily newspapers, however.

QUESTION: That's not my point. I mean restrictions on the documentation on the system. I understood from talking to Mr. Roman this morning that the detail documentation, flow charts, programs, etc. would not be available to us because Purdue paid for them, and the company involved does not want to give away what they are in the business of selling. I can truly understand that from a business point of view. What is being developed is very similar, I understand, to what Purdue has for its own serial record. Does this mean that you are not going to make information on the state project available? In other words, in Ohio we want to develop a union list, and if we want to copy yours, can we?

MR. MOUNT: As far as I know, this would be up to the Indiana State Library. Perhaps their state representative, Mr. Art Hill, would be the one to write and ask. As far as I'm concerned there would be no restrictions in handing this out. I don't know about the systems people, however. They make a lot of money this way. If you read Computer World or any of the computer magazines, there will be 4 or 5 pages devoted strictly to systems that are working toward a given software-hardware configuration. They are being sold for $150 or $200. Money is made this way. I know of one case where a technique has been patented.

Programs can be copyrighted now, and most of them that are sold have been copyrighted. But as far as I'm concerned we'll have this available to use, but the State Library is in control.

QUESTION: It was our understanding that we would receive a copy of the printout. Is this correct? Will we get the total printout?

MR. MOUNT: Yes. This printout will be in book form. I assume that all participants will get a copy. We are under contract to deliver 200 copies to the State Library and they will do the distributing. I believe each participant will get at least one copy. This will not be in computer printout 15 by 11 inch page. We're going to reduce this to either 8 1/2 by 11 or 9 by 12 or smaller size. The computer page can, of course, be extended as long as we want. We can make one 6 feet long, and they can reduce this to something that can be duplicated on a reasonably standard size page. It won't be a computer listing on big paper that you get.

QUESTION: Will copies be available to libraries outside the state?

MR. MOUNT: Well, of course, we will have the originals, so we can print as many as we want. The State Library, however, is in charge of this. We are now trying to get a cost estimate on our own serials system to see what it would cost to print it right now. We have had requests, and we might be able to sell these. We don't think we will be able to get the money to produce them and then give them away. It seems to me that if the State Library meant to sell copies of the state list they would need more than the 200 they asked for.

QUESTION: I am wondering about future plans. We seem to have a film catalog and the Union List of Serials coming out within the next year. Where do we go from here in the automation of libraries? What's Purdue up to next if this isn't giving away a secret?

MR. MORIARTY: Well, I don't know. There's always a limit on the machine. We're given three hours of time per week, and that's a lot of computer time, as far as that goes. There's a figure in the budget of $35,000. It's institutional money that's allotted to me as a share on the computers. I have to keep that in mind about programs. But there is no secret particularly about projects. One of the things the Spanish people want is a reclassification of Spanish literature. Our suggestion to them instead of a reclassification is that we computerize the 5,000-6,000 volumes in the Spanish collection and give them a book catalog for their offices, and leave the call numbers that we have on the books. I think it's going to be cheaper for the institution to do it that way and perhaps more satisfactory for them in their knowledge and use of their material. Now that's one thing. Universal catalogs computerized, though, is something that I really don't favor, unless the scattering of the information, such as in departmental libraries would justify it. But I think even so the departmental libraries will only want parts of the union catalog even when they want other parts than their own holdings. But if the Pharmacy Library wants to know everything that's in the Veterinary Medicine Library, there's no reason why we couldn't do a computerized list of the veterinary material and give it to the Pharmacy Library, and vice versa. But to just go in there and computerize everything from A to Z with all the obsolescence we have in that catalog, this is a lot of nonsense. I'd rather respond to needs is what I'm saying.

THE LIBRARY AS A TOTAL INFORMATION RESOURCE

Bernard M. Fry, Dean
Graduate Library School
Indiana University

I would like to discuss with you this evening what seems to me the most crucial problem facing libraries today, namely the relation of libraries to computer-based information systems, particularly in relation to the mushrooming national information systems and services which, for the most part, are being established outside of libraries. In a sense, what I propose to discuss is the rationalization of traditional library services in an environment of a growing flood of new information with which we are all familiar. One aspect is that of competition for the information functions. Another is the need for acceleration of planning for network planning in this state.

Viewed another way, I believe our historic function of "putting knowledge to work" is being challenged as never before by new social problems and needs which require direct involvement and participation by libraries and provision of new and improved information services.

Along with the proliferation of new information forms and sources there has been a knowledge revolution characterized by systematic application of useful new information to a wide range of social-economic-technical needs. The most dramatic example has been the technology transfer programs which utilize the results of research in atomic energy, space, defense and other national programs.

Beyond this, there has been the worldwide awakening to the realization that information is not simply a matter of logistics but is one of the most crucial of national resources. This fact has been high-lighted in this country by the determination of Congress and the President under the State Technical Services Act that "wider diffusion and more effective application of science and technology in business, commerce, and industry are essential to the growth of the economy, to higher levels of employment, and to the competitive position of United States products in world markets." Information services and systems are depended on to provide improved mechanisms to bring new scientific and technical information to business and industry, whose viability and growth require the innovative use of technical knowledge.

Our culture is, of course, changing in many important ways in addition to the accelerating growth in science, technology and industry. Although many of these changes are self-evident, it is useful to recall some of the influences at work which have a bearing on the use and users of library and information services: the growth of population; the transformation of our society from rural to urban; the shifting patterns of state and local government; pollution of the environment and depletion of natural resources; the changing tax structure; the harassing problems of interracial adjustment; the attack on poverty and social welfare generally; the need for expanded educational resources at all ages, even the pre-school years; the burden of the illiterate or functionally illiterate; the importance of a citizenry enlightened about world problems--all of these present needs and requirements for library and information services that challenge the imagination and creativity of librarians in all types of libraries--public, special, academic or research.

The transfer of knowledge and information--from industry to industry, discipline to discipline, region to region, country to country--has been a continuing process throughout the history of man. Information transfer should not then be considered a new and untried concept. However, the current thrust is to speed the transfer process, i.e. to shorten the time gap between the discovery of new knowledge and its application across a broad range of social-economic-technical needs. The development of really effective ways to accomplish this transfer process requires the participation of librarians dedicated to improved information services, along with information scientists of all kinds including computer specialists, systems designers, linguists, communications experts, and those with expertise from many other fields.

In the library profession there is increasing concern as to whether libraries can stay in the mainstream of information service, and as a communications center, in this period of great social change accompanied by the mounting flood of information.

Librarians themselves are the first to recognize that the solution to effective control of the accumulating new information is not simply more books, more buildings, and more librarians. Many look forward to a change in the very concept of what a library is: this is, beyond its function as a depository of books, the library must become a source of active information transfer and a total information resource. The new technologies offer the long-range hope of realizing this concept. Through computer storage and retrieval, microforms, long-distance transmission, and the like, we can expect to multiply the usability of all information units and to transcend the physical geographical limitations of the library building. This is the picture of libraries in the future, perhaps 15-20 years away.

What demands attention today, however, and requires prompt initial steps toward its solution is a direct result of the information explosion of the last 20 years and the still accelerating growth of literature in almost all fields. Attempts to control the growing flood of new information have led to the development of large scale national information systems and services in many disciplinary and project areas, largely outside of libraries, and under the sponsorship of professional societies, government agencies, publishers, microform manufacturers, and indexing and abstracting services. By taking a more active role in design and formulation of these information systems, librarians and libraries of all types--whether public, academic, special, research, industrial--can make important contributions to their effectiveness and efficiency.

The advanced information systems and services of today, most of them computer-based, have for the most part not been established on any logical or predetermined basis. They are widely duplicative and overlapping and they cannot be meshed with systems in other information fields. Their interface is characterized by both machine and intellectual incompatabilities. You are familiar with most of the new systems I have in mind:

MEDLARS
Chem Abstracts
English Index (IEEE)
Clearinghouse tapes
MARC (Library of Congress)
IAEA - Nuclear Science Abstracts
Neurological Information Network

Physics Abstracts
Biological Abstracts
Science Citation Index (and source indexes)
Census tapes
Social Science files
Project URBANDOC - HUD
Transportation
Water Resources

--most are anticipating remote on-line, real-time terminal systems: central computer

--in addition to format, programming and machine differences, the depth and kind of indexing makes it a nightmare for librarians to useemore than one tape file (or terminal system)

--or to supplement conventional sources with computer searches.

I am sure others have covered some of this ground in today's meeting and I don't want to over-emphasize the difficulty of using mechanized systems.

The point I do want to emphasize is that increasingly libraries of all types will need to rely on mechanized files: remote terminals or central data banks to supplement conventional sources, in order to provide the total information resources which society requires today.

Overlaying the practical problem of controlling the increasing volume of printed material, however, is the need of the user to have a single point of access to the total information resources available on a particular subject. This may involve published and unpublished materials, information on current research, data of all kinds, and referral to sources of expertise whether individual or corporate. Thus, the user may be provided complete service, not limited just to citations in books and journals.

This means more than an interest in computers and mechanization. It means library participation in communication systems which will provide useful access to total information resources, either directly or in close cooperation with other government and private organizations on a local, state, or national basis.

There is another issue involved in relating libraries to computer-based information systems and that is the correlative issue of inter-library cooperation. This is, of course, an old and honored term in our professional vocabulary. It has taken on new meaning, however, in recent years as improved means of communications and computerized information handling have been developed. Today in several states there are being planned, or are in early stages of operation, state network information systems, some of which encompass all types of libraries (as for example in Washington, Vermont, and Rhode Island) and others are limited to state universities (as in New York) or are public library oriented as in Maryland. Maryland's public library network is attempting to centralize some functions not commonly handled at the state level, such as acquisitions, cataloging and processing. In addition, there are numerous regional cooperatives which have for some years performed several centralized or cooperative functions such as lending and reference referral. The importance of automation in these library networks is recent but growing.

Perhaps the most advanced state-wide planning and implementation has taken place in New York, where the first user-oriented, immediate response computerized library system began operation last month. The on-line, real-time system, called the SUNY Biomedical Communication Network, links the four medical center libraries of the State University of New York and the University of Rochester Medical Center Library. The SUNY libraries are located on the campuses at Buffalo, Stony Brook, Syracuse (Upstate Medical Center), and Brooklyn (Downstate Medical Center). The network aims at making it possible for faculty, researchers, and students to search the list of over one million medical books and journal articles available in the participating libraries in less than two minutes.

All recent catalog records in these four libraries are being converted into machine-readable form for computer input. Further, all new material is being converted as it is acquired by each center. In short, the scheme provides for a computerized union catalog, completely current and available to all four centers through typewriter input and output terminals.

The New York Task Force concerned with the total library network planning concentrated on four basic recommendations. Specifically, it called for: 1) the establishment of a communications network between the libraries on all campuses; 2) the formation of a union catalog of all listings of the 58 libraries; 3) an improved system of interlibrary loans; and 4) the establishment of a system-wide plan for the purchasing and processing of materials.

Although Indiana has a well-developed and functioning teletype and long distance telephone network--which includes the Indiana State Library (with a separate TWX network of 26 libraries) and the Indiana University School of Medicine which serves public libraries in 122 communities--progress on planning for state-wide networks lags behind several other states. A bright spot is Don Hammer's work underway at Purdue, using LSCA funds, for the development of an Indiana Libraries Serials Data

Bank. Purdue has, of course, pioneered in the exploration and application of ADP to university libraries. There is, in addition, a scattering of library automation activites throughout the state, of which the Crawfordsville processing center is an outstanding example of centralized processing for public libraries on a regional basis.

If adequate support and exploitation of technology are realized, a most dramatic change could be made in improved and expanded communication and cooperation among libraries. Communication networks could provide data processing capabilities; reduce duplication and cost of purchasing and processing; and, at the same time, increase their service to users through rapid inter-library loans, improved reference support, and the outright distribution (rather than loan) of certain kinds of material. Active dissemination of certain types of information could be commonplace. Non-book materials could be exploited by libraries of all sizes and types, and could be available virtually anywhere.

We have an unequaled opportunity to develop a sound and effective state-wide plan. We could begin by building on the first state-wide study of Indiana libraries now underway, sponsored by the State Library and under the direction of Peter Hiatt. This study is unique among state studies because it is starting with an attempt to identify needs in the State for the kinds of materials and services which libraries of all types can supply. These needs will then be compared to present library performance, and recommendations--which will help bring Indiana the library service it needs--will follow. Changes in patterns of library service will, undoubtedly, be necessary, and the immediate goal will be to develop necessary legislation for presentation to the 1971 session of the Indiana General Assembly.

The next step will be to take action on this study, and I suggest that we use it as a base for planning a state-wide information and library network, including such cooperative ventures as centralized purchasing and processing, computerized operations, state and regional communication systems, regional special collections, and all other library functions that can be more effectively and economically administered through joint efforts.

Library network research is fundable under the Higher Education Act of 1965, and also under the Federal Library Services and Construction Act. In 1967 the Indiana General Assembly enacted the Library Services Authority Act which aims to encourage cooperation among libraries of all types. This act is being administered by the State Library which will have limited funds to implement this policy under the LSCA. Library network research is also fundable under the Higher Education Act of 1965.

ORGANIZATIONAL ANALYSES AND SIMULATION STUDIES OF UNIVERSITY LIBRARIES*

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Three research studies, which were conducted as part of a long-term research program dealing with organizational analyses and simulation studies of university libraries, are discussed and the methodologies utilized are made explicit. The first study draws from organization theory and economic decision theory to develop a model of the library/user/funder complex. Industrial dynamics is used in the second study to construct a computer simulation formulation of the library/user/funder complex model. Two simulation applications, dealing with library controls procedures and with library resource utilization respectively, are presented and implications for library operations are drawn. In the third study, sequential search theory provides the framework for deducing optimal user search sequences. Criteria sufficient for determining optimal search sequences are derived for several postulated forms of the user evaluation function. In addition, parametric analyses are conducted in order to relate library operations to optimal user search behaviors. A final section attempts to integrate the three studies and identifies areas for future research.

Early in 1966 a descriptive model of the library/user/funder complex was proposed as a framework for describing, and for aiding in the understanding of, the behavior of the primary participants in a university library organization. Initially, this model was developed to provide an overview of the library which could be used for evaluating other, more micro, studies of university library systems, e.g., book shelving, secondary storage decisions, statistical procedures for describing holdings, etc. In addition, it was anticipated that the model would aid in identifying other, more macro, possibilities for future research. With the completion of two recent studies, this anticipation has been at least partially realized.

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** Completed while Dr. Baker was an Associate Professor in The School of Industrial Engineering, Georgia Institute of Technology.

The purpose of this paper is to document and summarize the present status of this long-term program dealing with organizational analyses and simulation studies of university libraries. In specific, three substudies will be discussed -- the development of the overall model of the library/user/funder complex, the development and utilization of the computer simulation model based on the overall model, and the mathematical analyses of the user decision problem. Previous papers have treated various portions of this research in relatively complete detail, e.g., [1, 2, 3, 4, 18] ; however, for the sake of clarity and completeness, this work will be summarized in the present paper.

In addition to summarizing the present status of the research program, the three studies also illustrate some of the methodologies which have been utilized. The development of the overall model depends heavily upon the theories and methodologies of the behavioral sciences and of economic decision theory, especially as practiced by operations researchers. The approaches utilized by proponents of industrial dynamics serve as the guidelines for the construction of the computer simulation program and the subsequent simulation studies. Finally the mathematical optimization techniques used in sequential search theory provide the methodologies for examining the user decision problem. In summary, the goal is to illustrate the methodologies and summarize the results of a long-term program researching the administration of university libraries and to accomplish this in a form useful to practicing librarians as well as to students of library administration.

A GENERAL MODEL OF THE LIBRARY/USER/FUNDER COMPLEX

In order to describe, design, or evaluate university libraries, it is not sufficient to consider the university library as a separate entity. The behavior and utility of a university library is constrained and influenced by actions of the funders and the users of the library. This section of the paper defines the overall model of a university library which has guided our studies since early in 1966 and is based on viewing the library as a service organization and on the reward-cost theory of behavior.

Funder-Library Action and Interaction

The funders are defined to be those persons who provide the resources which enable the university library to operate. Because of their direct control over resources, the funders have an opportunity to exert control over the library. The funders typically reserve the right to evaluate the performance of the university and future allocations, both amounts and kinds of resources, are often partially influenced by the outcome of these evaluations.

Two different constraints can be imposed by the funders -- resource constraints and operational constraints. The most obvious resource constraint is the overall budget constraint which constrains the university library to utilize no more than some specified amount of the available resource. A more binding form is the activity constraint which restricts the library to spend no more than a specified amount of the resource on a particular library activity. For example, the funders may inform the library that its book budget for the coming fiscal year is X dollars and that the library is not to exceed this by more than 10%. The funders may also enforce a minimum activity constraint, e.g., do not spend less than Y dollars for books. The difference between X and Y is a measure of the freedom the funders give the library in its book budget decision. The two extreme cases are when $X-Y=0$, which represents "complete control", and when $X-Y=$ overall budget, which represents "complete freedom." Any number of possibilities exists between these two extremes.

Operational constraints are not so direct as resource constraints and often become attempts to influence rather than to constrain or control. The concern here is with funder statements to the university library which take the form of defining acceptable operating characteristics. For example, statements such as "provide an adequate collection of local and state history" can be made by the funders and function as operational constraints. Although not as direct as the resource constraints, the operational constraints also act to influence the behavior and utility of the university library.

The previous comments have assumed that there is one dominant funder or that there are several funders who operate as one funder. If there are several funders who operate independently, for example when several academic departments each provide resources or when each user purchases services, then opportunities for funder control are minimized. However, it is still possible for the funders to attempt to influence the behavior of the university by imposing conditions on the continued availability of their resources. For example, the users could purchase services from another source which better satisfies their needs.

User-Library Action and Interaction

The reward-cost theory of behavior [11, 22] provides a base for hypothesizing user behavior. Each user is faced with a complex decision problem. For any given need for information, the user must identify one or more sources which could be approached in search of need satisfaction. The set might include such sources as contact someone who could provide the information, search a private collection, or let the need go unsatisfied (at least for some reasonable length of time). Regardless, once alternative sources have been identified, some expectations or measures of attractiveness, relative to the specific need(s) and sources, are established. Simon's principle of "satisficing" [17] suggests that sources are identified and expectations are established only until a sufficient number of satisfactory sources has been generated. Thus, the user is unlikely to identify all possible sources and may, or may not, establish expectations for all the sources which are identified. Further, the suggestion that user evaluations are need specific implies that perhaps library and funder evaluations should also be need specific. This implication appears to be especially relevant for diagnostic evaluations, i.e., when the library or the funder is determining the contribution expected from an innovation in service.

Reward-cost theory also provides a possible explanation of how expectations and measures are determined. The units of exchange to the user from the user-library interaction are rewards and costs. Rewards are defined terms of need satisfaction, i.e., the user is rewarded from interaction with the library (or any other source) to the extent that his need or needs are satisfied. Costs are defined as factors which inhibit or deter opportunities for rewards. When there are several alternative sources, a cost arises whenever a source is selected and the need is not satisfied. Thus, the reward-cost expectations are a function of factors such as likelihood of need satisfaction, time, energy, and money necessary to determine if the selected source will result in need satisfaction, and the convenience of using the system. For example, see the Rubenstein, et.al., study of X-ray crystallographers [21.]

Once expectations have become well-defined, reward-cost theory suggests that the user is required to give less attention to reward-cost evaluations and searching for alternative sources. Only when the environment begins producing outcomes which are not commensurate with expectations will a user return to a consideration of the reward-cost consequences of his behavior. At this point the process repeats and, very likely, the user will reorder this assessment according to current expectations. Two interesting implications can be drawn. First, the signal for reassessment is under the control of the sources being utilized, i.e., reassessment is initiated when outcomes are not in line with expectations. If a university library is not being utilized, then any changes it may implement will not signal reassessment unless the library employs special means of informing the user. Second, even if reassessment is signaled and takes place, those sources which have low current expectations may never be reassessed if a satisfactory source is found prior to their being reassessed.

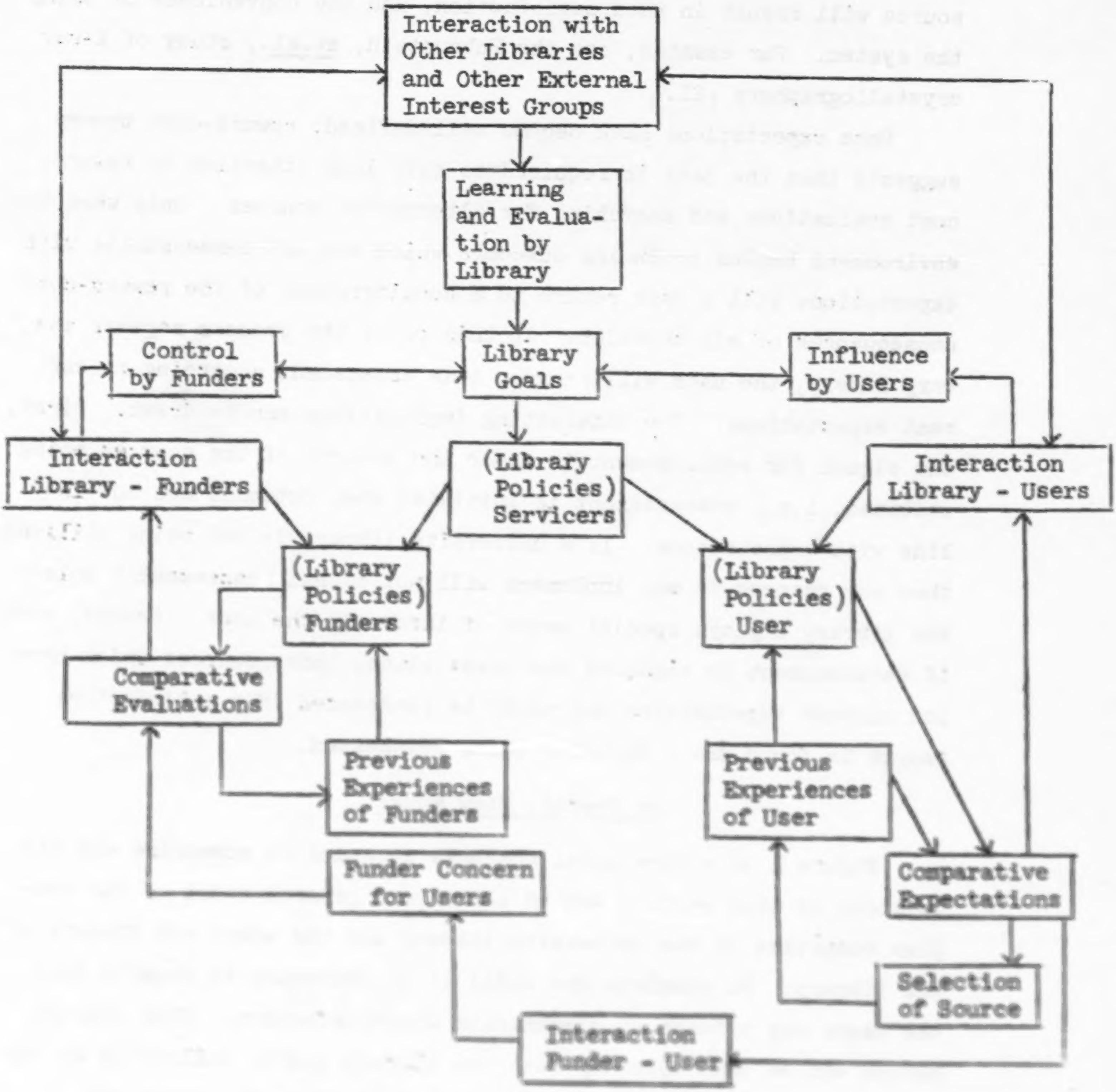
An Overall Flow Model

Figure 1 is a flow model which is intended to summarize the discussions of this section and to serve as a general model of the complex comprised of the university library and the users and funders of the library. To complete the model it is necessary to observe that the users may attempt to communicate dissatisfaction. This communication can be made directly with the library and/or indirectly by way of the funders. Note that the special case where the users and funders are identical presents no conceptual difficulty in the model.

One last point is worth mentioning. Feedback from either the users or the funders can be interpreted in two ways. The first is to interpret the feedback as attempts to influence and/or control

Figure 1

MODEL OF LIBRARY BEHAVIOR


Interaction with Other Libraries and Other External Interest Groups
Learning and Evaluation by Library
Control by Funders
Library Goals
Influence by Users
Interaction Library - Funders
(Library Policies) Servicers
Interaction Library - Users
(Library Policies) Funders
(Library Policies) User
Comparative Evaluations
Previous Experiences of Funders
Previous Experiences of User
Funder Concern for Users
Comparative Expectations
Selection of Source
Interaction Funder - User

the future behavior of the library. On the other hand, feedback can be viewed as an opportunity for the university library to learn more regarding user and funder expectations. Either interpretation suggests the possibility of modified behavior on the part of the library. It may be in the best interests of the library to stress the learning aspects of feedback in order to lessen the possibilities of external control and/or influence. The problem of outside control by users (or funders) is common to all service organizations and clear examples have been documented [5, 13].

AN OPERATIONAL APPLICATION OF THE GENERAL MODEL

In the discussion of the general model of the library/user/funder complex and from the model of Figure 1, one can distinguish two characteristics: the importance of feedback in determining the behavior of the components, and the significance of time in the reflection of behavior. An attempt to operationalize the model will in most cases introduce two further characteristics; the inability to portray decisions or policies controlling behavior with simple functional forms (e.g., linear or continuous functions), and the immense size of the complex which is under analysis. These four characteristics -- importance of feedback, significance of time, presence of ill-structured functions, and the immense size of the problem -- suggested the applicability of the simulation technique, industrial dynamics [9], in the study of departmental libraries at Purdue University.

Model of the Complex

A library is an information storage and retrieval system, but an information storage and retrieval system is not a library. The truth of this statement becomes apparent when one observes the interaction of users with a departmental library. The need for study space, although somewhat independent of the information function, is a prime need of the student user. Following the concept of system "utility" defined by Ernst [8], all major needs which bring a user to the departmental library should be considered.

An overview of the model of the library/user/funder complex is shown in Figure 2. The focal point of interest in the study is the library, which has been divided into five sections or sectors. The funding and user portions of the complex are modeled in one sector for each. By considering a departmental library, the analysis has excluded virtually all of the processing work associated with library operations. The model focuses on those activities undertaken by the library which precipitate interaction with the users and/or funders. These activities include: (1) ordering of materials, (2) book loan, (3) periodical loan, (4) provision of service personnel, and (5) provision of space for storage of collection or for study.

In Figure 2 broken lines indicate the flow of information and solid lines indicate material flows. Note that the sector of user needs emits only information. The user interacts with the library in an attempt to satisfy one or more needs through usage of library resources, and in the process, the user may communicate his satisfaction or dissatisfaction with library services. The reaction of the library may be to provide the services sought by the user or to communicate the unavailability of the resource(s) in demand. Thus the double arrows on some of the information flow lines in Figure 2 indicate that these communication channels are duplex.

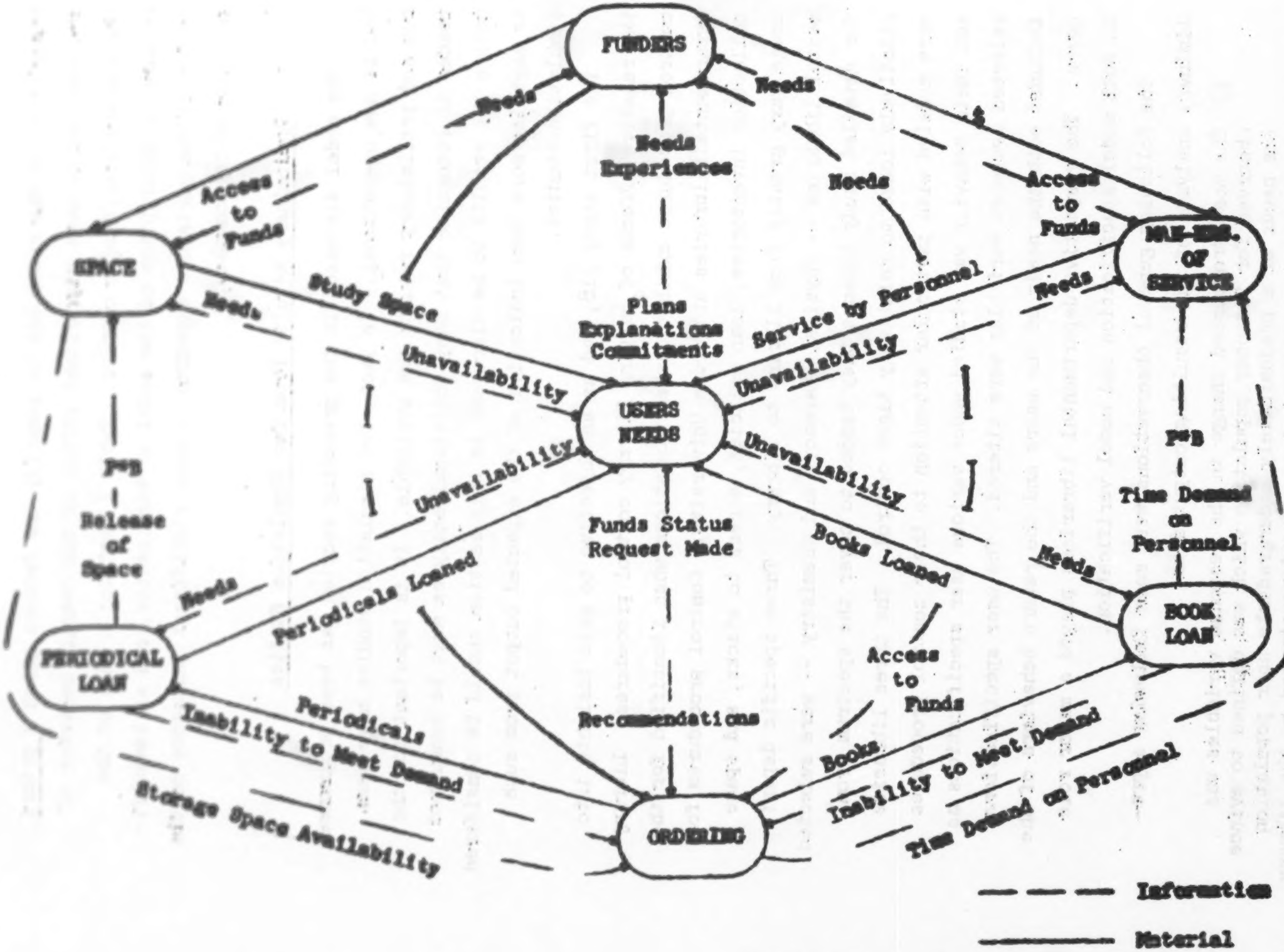
The interaction of the users with funders is in the form of communication of needs and the ability or inability of the library to satisfy these needs based on the users' past experiences. This, in turn, may precipitate statements of plans, explanations, and commitments by the funders.

Funders interact explicitly with the library in providing operating funds and information concerning the availability of funds. The specification of operating constraints is implicit in the modeling of library policy structure and the provisions for policy alterations. Funder evaluation of library operation is not incorporated in the model since it has not appeared as a factor in funder-library interaction. Communication from the library to the funders generally consists of the expression of requests for additional funds to be used for space, personnel, and/or collection increases.

It is beyond the scope of this paper to present the individual sector models in full detail. Future publications will deal with detailed presentation of models, data collections procedures, and analysis of results. However, it is possible to present a brief

Figure 2

MODEL OF LIBRARY/USER/FUNDER COMPLEX


FUNDERS
SPACE
MAN-HRS. OF SERVICE
USERS NEEDS
PERIODICAL LOAN
BOOK LOAN
ORDERING
Needs
Needs
Needs Experiences
Needs
Access to Funds
Access to Funds
Study Space
Needs
Plans Explanations Commitments
Service by Personnel
Needs
Unavailability
Unavailability
Unavailability
Unavailability
P&B
Release of Space
P&B
Time Demand on Personnel
Funds Status Request Made
Books Loaned
Needs
Needs
Periodicals Loaned
Access to Funds
Recommendations
Periodicals
Inability to Meet Demand
Books
Inability to Meet Demand
Time Demand on Personnel
Storage Space Availability
Information
Material

P&B Indicates that this flow occurs both for periodicals and for books description of the model and to identify the factors which a priori, are expected to have significant effect on the overall behavior of the library/user/funder complex. Table 1 contains a list of the sectors, a description of the model of each sector, and an identification of the variables expected to have significant influence on the behavior of the complex.

Preliminary Results From Two Simulation Studies

The model discussed in the preceding section has been programmed and is now operational. In fact, two simulation studies have been run and preliminary results are available. It is important for the reader to recognize that many additional analyses must be conducted before the results to be discussed in this section should be considered as anything more than indicative of the expected output from such simulation studies.

The first study [18] had as an objective to gain insights into the relative effects of varying library control procedures. Library control procedures exhibit marked variations when identified for the departmental libraries at Purdue University. Control procedures for collection inventories, loan policies, access to stacks, and space usage vary greatly from library to library. Three specific departmental libraries -- Physics, Pharmacy, and Chemistry -- were selected for detailed study because they tended to cover the spectrum from relatively loose to relatively tight control. The three libraries were modeled with particular attention to their control procedures and their behavior was studied under various user specifications as selected response variables were altered. The user specifications included both the needs of the users and the return behaviors of the users. The respective departmental librarians played a major role in both model specification and model verification.

The following general observations were made following a preliminary analysis of the resulting output data:

1) The most pronounced change in the response variables was observed for the user population which was defined to evidence the needs of a predominately undergraduate user population and the most pronounced change was demonstrated by the library with the most stringent controls procedures.

Sector	Described by:	Emphasized:
Users' needs	Users' contact with library; development of user pressure on funders and library for increased services.	Factors contributing to users' need satisfaction
Ordering of Material	Flow of users' recommendations into orders by library and subsequent arrivals of collection additions.	Sources of recommendations, factors affecting the proportion of users' recommendations which are ordered.
Book loan	Flow of books from library to user and delays in return of books; library policy for loan and return of books and reaction to loss of books.	Factors affecting users' return of books either late or on time, library policy reaction to delay.
Periodical loan	Flow of periodical issues into collection as generated by subscriptions, binding delay in conversion of periodicals into bound form, library policy for loan and return of periodicals and reaction to loss of periodicals.	Factors affecting the users' return of periodicals either late or on time, library policy reaction to delay.
Man-hours of Service Sector	Usage of service time in accomplishing the demand on personnel arising in other sectors.	Factors requiring expenditure of time by library staff, decisions as to increase or decrease in staff size.
Space	Flow of storage space available into used space for storage, usage of study space by users, transfer of space from study to storage category.	Policy statement for transfer of study space to storage space.
Funding	Flow of allocated money into encumbered then expended accounts for books and for periodicals, flow of money from outside sources into library budget.	Policy for requesting money from outside sources, effect of budget size, transfer of money from book to periodical account.

Table 1. Description of Models of Individual Sectors.

2) The observation of one library model's exhibiting the largest degree of change does not hold as the user population is altered from evincing predominately undergraduate needs to predominately graduate student needs and then to predominately faculty needs. The indication is that the effects of controls procedures become less pronounced as the user population becomes more highly research oriented.

3) The description of the user population simply in terms of their needs produces a far greater effect on the simulation results than the description of the users only with respect to their return behavior.

4) The interaction effect, created by investigation of the combination of all users sets exhibiting different needs with the sets reflecting different return behavior does not appear to be substantial. Apparently the effects due to different user needs dominate the effects due to different user return behaviors.

It is premature for us to do more than present these observations. Substantially more work must be done before any "conclusions" can be drawn. However, experienced professional librarians should be in a position to evaluate these observations relative to operating considerations.

The second study was concerned with the analysis of impending change in the Physics Library and was conducted following a request from the Physics Librarian for aid in designing the policies to be effected in the operation of a new library. The Physics Library resides in two rather small rooms of the Physics Building on the Purdue Campus. For the past several years, the physics collection has been too large for the space afforded by the available facilities. Consequently, seating space has been decreased, material has been crowded into shelving space, and loan procedures have become exceedingly flexible. Demand for space during the period in which this library was studied was critical to the point of restricting the addition of library staff. The Physics Library was the library selected as the "loosely controlled" library in the simulation study.

The Physics Library will be moved to a new building in September, 1970. The space afforded by the new facilities will be more than quadruple that of the existing facilities (8144 square feet as compared to 1821 square feet). Shortage of space - the current critical problem of the library - should no longer be a major problem. With the change in facilities, a review of policies is being conducted. Two different policy changes are being considered:

> Policy 1: closer control over the library collection and more restrictive loan policies with increased cost of $5,000 annually to extend operating hours and staff availability, or

> Policy 2: less control over the collection with more extended loan policies and increased purchases of multiple copies at an annual cost of $5,000.

Essentially, the choice lies between the allocation of funds for additional staff in the attempt to increase the availability of the information services or the use of funds to purchase multiple copies of volumes evincing high circulation. Compromise strategies are also feasible.

The model of the Physics Library was studied under its original policy with regards to loans and under the revised policies (Policy 1 and Policy 2). An examination of the subsequent output data indicated that the results of applying the two revised policies can be summarized as follows:

1) Policy 1, which calls for more restrictive loan procedures with an increase in operating hours, effects marked decreases in the delays in the return of books and periodicals, but causes a higher degree of dissatisfaction among the users of the library.
2) Policy 2, which entails less restrictive loan policies and the purchase of multiple copies, results in a longer delay in the return of periodicals with little change in the return delay of books and stimulates a higher degree of satisfaction among the users of the library.

Neither of the policies evoked indications of model instability.

The results of the study of the model of the Physics Library are not offered to the librarian and the library staff as definitive truth that one policy is superior to another. In fact, no such conclusions can ever be drawn from simulation studies such as described. What the results of this study can provide the librarian is a more objective means of evaluating the effect of policy changes before the respecification of policy is implemented. Responsibility for interpreting these results and for making the decision as to which policy should be adopted still rests with the librarian, the department administration, and the directors of the total library system at Purdue.

Comments on the Simulation Studies

Strategic simulation studies, such as the studies described herein, are time-consuming and costly, but the final result should be a vehicle which can probe many interesting problem areas. Other interesting applications of the generalized model might include the funder and user subsystems. One might use the model to investigate the system behavior under varying budget levels imposed by the funders. Or, one might observe the model's response under increased communication between the users and funders resulting sensitivity of the funder to the users' demands.

Simulation studies represent only one means of investigating the Figure 1 model. It is also possible to conduct mathematical analyses. In fact, because of the expense and time involved in conducting simulation studies, mathematical analyses should be attempted whenever feasible and meaningful. The studies discussed in the previous sections fit into the category of being too complex to permit meaningful mathematical analyses, at least with the existing mathematical methodologies at our disposal. In the next major section, the user source sequencing problem will be discussed from a mathematical point of view. In addition to yielding important insights into the problem, it will also serve to illustrate opportunities for operations research studies relative to the administration of university libraries.

OPTIMAL USER SEARCH SEQUENCES AND IMPLICATIONS

The "User-Library Action and Interaction" section briefly described the user decision problem. The purposes of the present section are to expand, formalize and investigate the problem. The following terminology is required in order to accomplish this purpose. Let $i=1,2,\ldots, m$ denote the alternative sources of need satisfaction, e.g., a university library, a private collection, a book store, etc., and let $j=1,2,\ldots,n$ represent the various needs of the user, e.g., information needs, study needs, etc. Following Thibaut and Kelley [22], define $E=\{e_{ij}; e_{jalt}\}$ as the set of all user expectations where e_{ij} represents the user expectation regarding source i relative to need j and e_{jalt} represents a comparative expectation relative to need j. For example, e_{jalt} may be the expectation level for "satisficing" and once a satisfactory number of sources have been identified such that $e_{ij} \geq e_{jalt}$ for each i and for some j then the user may search no further. Conversely, if $e_{ij} \leq e_{jalt}$ for all i, then no satisfactory source has been found and the user may decide to let the need go unsatisfied at least until the need becomes of such urgency that an unsatisfactory source is accessed or until a satisfactory source is identified. Regardless, the behavioral description of the previously identified section provides sufficient structure to determine optimal user search sequences for various forms of evaluation functions.

Several Sources - One Need Analyses

Let us first consider the situation where the user has one need, or alternatively one homogeneous class of needs, but several possible sources of need satisfaction. The problem then becomes, given an e_i form, to determine how the user should sequence the sources in his search for need satisfaction. Two e_i forms will be discussed in this section.

Define p_i as the probability that source i will satisfy the need and assume that p_i is independent of the probabilities associated with the other sources and the order in which the sources are examined. Let c_i be the cost per unit time associated with source i and t_i be the time required to determine if source i examination will result in need satisfaction. If we assume that $c_i = c_i t_i$ and assume that the user seeks to minimize the expected cost required to satisfy the need, then the problem is to find the sequence of sources which will result in such a minimization. The total cost of a sequence S is given by

$$C_S = \sum_{i=1}^{n} c_i t_i \prod_{k<i} (1-p_k) \qquad (1)$$

where $k<i$ is defined as "source i precedes source k in the sequence S".

Using techniques of sequential optimization which have found application in sequential search theory [7], it can be shown that if the sources are ordered such that

$$\frac{p_i}{c_i t_i} \geq \frac{p_{i+1}}{c_{i+1} t_{i+1}} \quad \text{for } i=1,2,\ldots,m-1, \qquad (2)$$

then the associated search sequence will have minimal expected cost. Note that $\frac{p_i}{c_i t_i}$ can be thought of as a rate of need satisfaction per cost expended. Further, if $\gamma_h \sum_{i=1}^{m} \frac{p_i}{c_i t_i}$, then γ_h is a monotone step function such that it is maximized for all possible values of $h=1,2,\ldots,m$. Both of these interpretations are consistent with a fundamental design principle in search theory that expected search effort is minimized by always distributing the effort sequentially so as to maximize the probability of target detection with the effort expended thus far [7,14].

Instead of desiring to minimize cost-time relationships, suppose that the user seeks to maximize expected reward. Let r be the return if the need is satisfied and postulate that $e_i = (rp_i - c_i t_i)$. The same optimization techniques referenced above verify that the return term will drop out and that (2) yields an optimal sequence for either situation. Accordingly, the optimal sequence, for either cost-time minimization or reward maximization, is a function only of p_i, c_i, and t_i -- the terms under the control of the sources. In other words, if the university library is able to clearly identify p_i, c_i, and t_i for its users, then the library has control over the terms which the user should utilize in order to determine his optimal sequence. Of course, these results are only as meaningful as the postulated forms of e_i, the user evaluation function.

Several Sources - Many Needs Analyses

Continue with $i=1,2,\ldots,m$ representing alternative sources and $j=1,2,\ldots,n$ representing user needs. Define:

p_{ij} = the probability of satisfying need j at source i.

t_{ij} = time to determine if j will be satisfied at i.

c_i = cost to access source i per unit time.

r_j = return if need j is satisfied.

Define $e_{ij} = r_j p_{ij} - c_i t_{ij}$ to be the expected return if source i is accessed relative to need j. Then the optimization techniques referenced earlier can be used to determine a criterion sufficient to define optimal user search sequences. Specifically, in order for S to be an optimal sequence, all adjacent pairs h,h+1 in the sequence must satisfy

$$\sum_{j=1}^{n}\left[(c_{h+1}t_{h+1,\,j}p_{hj} - c_h t_{hj}p_{h+1,\,j})\prod_{k<h}(1-p_{kj})\right] \geq 0. \qquad (3)$$

Note that here, as in the one source situation, the return term drops out thus resulting in a criterion containing only the factors under the control of the sources, e.g., under the control of the university library. Although (3) is not as simple as (2), it is sufficient to specify an operational procedure for determining optimal user search sequences [3].

Expected Value Criteria and Time Constrained Searches

The approach taken thus far in the section has been to determine search sequences which maximize expected return to the user or, equivalently, minimize expected cost-time investments by the user. In the absence of any other criterion form, the expected value form is not an unreasonable choice. Indeed, if the same search were to be repeated infinitely often, it would be an excellent choice. From the point of view of the university library analyzing its competitive positions, it is an acceptable criterion if many users are faced with essentially the same searches. However, from the point of view of an individual user, a specific search may be performed once or, at most, a few times. Under this situation, the expected value criterion is open to criticism. The distinction here is between several users performing one or more similar searches and one user performing one or a few similar searches.

The empirical literature dealing with library use [6,12] suggests that users are often faced with attaining need satisfaction subject to a time constraint such that if satisfaction is not found by t* then it is no longer rewarding. Time constrained searches are particularly common when the need is for information to be used in decision-making. Given such a restriction, the user may seek to determine the sources which will maximize the probability of need satisfaction within the t* restriction and then to order these sources so as to minimize expected search time. Once the sources have been identified, (2) and (3) can be utilized to determine the optimal subsequences.

Analysis of Potential Service Modifications

It was suggested in the previous section that the expected value criteria and the resulting optimal sequence decision rules were more reasonable from the point of view of the university library than from the point of view of the user. By performing parametric analyses on the terms in the user criterion function it is possible to deduce the effect of various service impoovement strategies which are open to the university library.

Multiple need search should be more efficient than $c_i t_i$. In order to reflect this, e_i is slightly modified to

$$e_i = \sum_{j=1}^{n_i} (r_j p_{ij} - c_i t_{ij}) - \frac{k_i}{n_i} \qquad (4)$$

where n_i is the number of needs for which source i is accessed by a representative number of users and k_i is a fixed cost incurred in order to access source i. Thus, e_i is modified by the introduction of a fixed cost contribution of the form $\frac{k_i}{n_i}$ which is greatest for $n_i = 1$ and approaches zero as n_i approaches infinity. Table 2 summarizes several parametric analyses on the terms in (4).

The results and comments presented in Table 2 are only as meaningful as the postulated form of e_i. However , given e_i as postulated, interesting implication can be drawn. Some of these are summarized below.

Service Modification	Resulting change in e_i	Comments
Reduce fixed cost by Δk. $0 \le \Delta k \le k$.	$\frac{\Delta k}{n}$	If $n=1$, then Δk results. As $n \to \infty$, contribution $\to 0$. $\frac{k}{n}$ form not necessarily realistic, but conclusion should be.
Add an additional service, $n+1$.	$e_{i,\,n+1} + \frac{k}{n(n+1)}$	As $n \to \infty$, contribution approaches $e_{i,\,n+1}$. Note $\frac{k}{n(n+1)}$ can be significant if n small and if k large.
Decrease cost per unit time by Δc_i, $0 \le \Delta c_i \le c_i$.	$\Delta c_i \sum_{j=1}^{n} t_{ij}$	Contribution a function of $\sum_j t_{ij}$. Good strategy if t_{ij}'s large and/or n large.
Increase probability of need satisfaction	$\Delta p_{i\ell} r_\ell$. $j=\ell$	Contribution becomes $\sum_j \Delta p_{ij} r_j$ is more than one p_{ij} is improved. As $p_{i\ell} \to 1$, $\Delta p_{i\ell} \to 0$ and $\Delta p_{i\ell} r_\ell \to 0$. Good strategy if $p_{i\ell}$ low and/or r_ℓ high.
Decrease search time by $\Delta t_{i\ell}$. $0 \le \Delta t_{i\ell} \le t_i$	$c_i \Delta t_{i\ell}$	Contribution becomes $c_i \sum_j \Delta t_{ij}$ if more than one t_{ij} is improved. Good strategy when c_i is high.
Trade-off between $p_{i\ell}$ and c_i.	$r_S \Delta p_{i\ell}$ $-\Delta c_i \sum_j t_{ij}$	If $\frac{\Delta p_{i\ell}}{\Delta c_i} \geqq \frac{\sum_j t_{ij}}{r_\ell}$, then increase in $p_{i\ell}$ accompanied with increase in c_i is an acceptable strategy. Converse also holds.
Trade-off between $p_{i\ell}$ and $t_{i\ell}$	$r\ell \Delta p_{i\ell}$ $- \Delta t_{i\ell} c_i$	If $\frac{\Delta p_{i\ell}}{\Delta T_{i\ell}} \geqq \frac{c_i}{r_\ell}$, then increase in $p_{i\ell}$ accompanied with increase in $t_{i\ell}$ is an acceptable strategy. Converse also holds.
Trade-off between $p_{i\ell}$ and k.	$r\ell \, \Delta p_{i\ell}$ $- \frac{\Delta k}{Z}$	If $\frac{\Delta p_{i\ell}}{\Delta k} \geqq \frac{1}{r_\ell n}$, then increase in $p_{i\ell}$ accompanied with increase in k is an acceptable strategy. Large n makes this more likely. Converse holds.

Table 2 continued on next page.

Service Modification	Resulting change in e_i	Comments
Increase $p_{i\ell}$. Decrease $t_{i\ell}$ at expense of c_i.	$r_\ell \Delta p_{i\ell}$ $+\Delta t_{i\ell} (c_i + \Delta c_i)$ $-\Delta c_i \sum_j t_{ij}$	Acceptable strategy if $r_\ell \Delta p_{i\ell} + \Delta t_{i\ell} (c_i + \Delta c_i) \geqq \Delta c_i \sum_j t_{ij}$. Note that as $n \rightarrow$ large, $\sum_j t_{ij}$ increases and $\Delta p_{i\ell}$ and $\Delta t_{i\ell}$ must be relatively large for this to be acceptable.

Table 2. Sample results of parametric analysis of $e_i = \sum_j [r_j p_{ij} - c_i t_{ij}] \frac{k_i}{n_i}$ relative to service improvement strategies available to a university library.

1) The number of services (or user needs) which are accessed at the university library by the users influences the extent to which the various service modification strategies are advantageous. The impact of change in fixed cost (k), or in the number of services accessed (n) is most meaningful when n is small; the impact of change in cost per unit time (c_i) is largest when n is large; and the impact of change in probability of need satisfaction (p_{ij}), or in time to determine if the need will be satisfied (t_{ij}), is independent of n. Accordingly, multiple needs libraries should endeavor to improve c_i and consider improvement in p_{ij} and t_{ij} at the expense of k. Similarly, single need libraries should seek to improve k and to increase n, at least to some reasonable limit.

2) The user/funder/library framework summarized in Figure 1 leads to the realization of the desirability of measures of service which are user needs specific. The entries in the "resulting change in e_i" column of Table 2 can be utilized to compute a user needs specific measure of the impact of specific service modification proposals.

3) Criteria are presented in the "comments" of Table 2 which can be used to determine when tradeoff strategies should be utilized. When r_j is large, strategies which improve p_{ij}, but which
    a) increase c_i should be utilized when search times are low.
    b) increase t_{ij} should be utilized when c_i is low.
    c) increase k should be used when n is large.

    The converse statements also hold.

4) The strategy of increasing p_{ij} and decreasing t_{ij} by increasing c_i can be an acceptable strategy even when c_i is large provided that $\sum_j t_{ij}$ is not excessive and, hence, may be more advantageous for a single need library than for a multiple needs library.

Since university libraries tend to be many needs service organizations, the large n comments appear to be the most relevant. It is again stressed that these implications are only as valid as the postulated forms as the user evaluation function. However, experienced professional librarians should be able to draw several meaningful operational conclusions.

DISCUSSION AND CONCLUDING COMMENTS

Three research studies concerned with the administration of university libraries have been discussed. The studies selected for discussion illustrate the various methodologies which have been used within the long-term research program underway in the School of Industrial Engineering and The University Libraries at Purdue University. Other studies have started from such viewpoints as modern inventory theory [16], statistical analysis [12, 19], human factors [10], and dynamic programming applied to storage problems [14, 20]. When these are coupled with the methodologies and viewpoints discussed in the paper - namely, organization and decision theory, industrial dynamics, and sequential search theory - one realizes the diversity of methodologies and viewpoints which have been applied in the studies of university library administration and operation.

However, the results emanating from the application of the methodologies and viewpoints should be at least as important. An overall descriptive model of library/user/funder behavior exists and has been used to evaluate and integrate previous studies and to define new areas for study. In fact, the last two major sections of the paper reported on research projects which resulted from the overall model.

The library/user/funder model clearly identifies three decision problems - one decision problem for each participant class - and indicates that these decision problems cannot be treated in isolation. All three decisions interact and must be analyzed with full recognition of their interactions. The user source sequencing investigations reported in the paper aid in understanding one aspect of the user decision problem and begin to relate library operations to this user decision. Similarly, the simulation analyses also stressed user-library interaction and yield additional insights relating library operations to user behavior and user satisfaction. However, much remains to be studied relative to user-library decisions and their interactions.

Other than identifying the user-funder interaction and a brief discussion of funder control and influence over library operations, literally nothing has been accomplished in studying the funder, the decision problems of the funder, or the implications of funder behavior relative to the library and its users. The apparent lack of literature dealing with the various funders of university libraries at private or state univesities makes it most difficult to perform the kinds of analytical studies discussed in the paper. It is our anticipation that eventually the three decision problems will be abstracted and analyzed and that a more powerful overall model will result.

In summary, much has been accomplished, but even more remains to be done. The methodologies of various disciplines have been brought to bear on the problem of university library administration, but even more clever applications must be made. The methodologies, the research areas, and the preliminary results presented in this paper are but a first step which hopefully will point the direction for the next generation of studies.

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AUTOMATION WORKSHOP CLINIC

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As has too often been the case, workshops per se, have either been Audio Visual demonstrations and/or lectures on "how we do it better our way right here in River City." In order to avoid this from occurring again, the directors of the Symposium felt that a truly hands-on approach was both desirable and in order. It was in this context that the Clinic was conducted and judging by the general favorable response, the venture was successful.

Physically the fifteen or so candidates for the project were exposed to the nature and function of the various Basic Electronic Accounting Machines. These were of the type one would find in any Data Processing Accounting Department, e.g. the key punch, the porter, the collater, the reproducer, the printer, the verifyer, etc. Some sample pre-key punched decks of cards were supplied and run through the various machines producing their respective demonstrable results. Initially, the logistics of the key punched card was explained inclusive of the Hollerith code, as well as the principles of field allocation and suggested uniformity.

On quite an informal basis, the class was introduced to card layout work sheets and practice time was allocated to the transcribing of information to the respective sheets from the raw data itself. A fixed format was explained and established and several examples were provided. This phase of the operation contributed considerably towards demonstrating the very essential factor of accurately capturing the information in such a manner that would permit for the maximum versatility in and of the products that would ensue. It was clearly shown that the principle was indeed worth the primary effort of recording all of the essential information once and one time only in a uniform manner. A proof of the pudding was when several members of the group suggested on their own volition that which had already been incorporated in many established operations, i.e. streamlining the transcribing process via the bypassing of the work sheets.

The next step in the operation was the actual key punching of the information from the work sheets. This phase of the operation the students found was more difficult than it appeared. This was in spite of the fact that instruction and supervision was provided. An interesting sidelight of this segment was the attempts by some members of the group to correct their errors by availing themselves of the adhesive properties of the library paste pot and the confetti generously supplied by the Workshop Leader. It didn't require much time for the group to discover that a more fitting and appropriate method of correcting a key punch error was simply to repunch a new card and destroy the old one. It really saved wear and tear on the equipment and wasn't quite as messy.

Once the above operation was successfully accomplished, the students took their sets of three reports, which averaged four to five cards per report, and personally ran them through the printer in the straight sequence they preferred, i.e. a one to one printout with no pre-arrangement for bibliographical citation. This served as a method for demonstrating advantages of the key punching format as well as allowing the students to understand the functions of the control panel of the printer.

Now the student had to choose which sequencing format he felt he required for his needs. In other words, how did he wish to juggle the information for a bibliographic listing of his holdings? The options were rather cut and dry. He could have alphabetical author sequencing, report number sequencing or issuing agency sequencing. He had the additional choice of merging his or her deck with that of several of his colleagues. In any case, he had to use essentially both the sorter and the collater and then back to the printer. In each and every case, under supervision, he did it himself and consequently made some eye-opening discoveries. The need for uniformity in transcribing, spelling, punctuation and general semantics were amongst the most apparent. Many other significant discrepancies were brought out as they had been intended by the workshop leader.

While the overt purpose of the project was to provide all concerned with a practical knowledge and familiarity with perhaps the most unsophisticated basic equipment on the market, the real modus vivendi was to bring the principles of systems analysis and design to the attention of the group in determining whether indeed any conceivable combination of hard and software were really necessary and applicable to their respective immediate and future needs. The primary disciplining of one's method of thinking out a problem by applying the very adaptable and applicable rules of Scientific Management should quite conclusively justify the need for the greater proliferation of clinics of this type. They have proven quite successful in the SLA New York Chapter area and have afforded many librarians with a new approach to their profession. This is in essence a course that no one flunks.

A secondary but nevertheless quite important by-product will manifest itself in any future communications between the libraries who avail themselves of this sort of Clinic and beyond, and programmers who are assigned to library projects.